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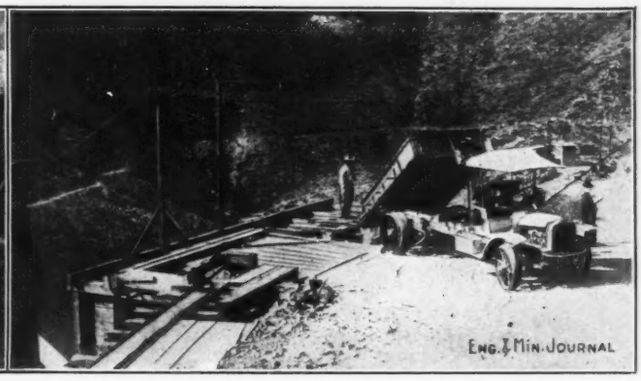
Motor Truck Ore Haulage in Arizona

By C. L. Edholm*

SYNOPSIS—Three motor trucks used for hauling ore over a steep 2-mile road from mine to mill in Arizona were satisfactory in general but disclosed various weaknesses. Wood blocks substituted for rubber tires. Springs were reinforced. Gasoline proved cheaper than distillate. Standard gear ratios too high for steep grades. Experience indicates that study of mining conditions would result in stronger trucks of improved design.

The results of the use of motor trucks for hauling ore over the rough roads of an Arizona mining camp are of interest to both mine operators and motor-truck manufacturers, and indicate that if a thorough understanding were reached by these two classes, trucks, especially built for ore hauling, might be made a reliable and economical means of transportation. The experiences of the Calumet & Copper Creek company, of Arizona, although in general, satisfactory, may throw some light on the weak spots in the commercial vehicle and indicate needed improvements. This mine makes use of a fleet of three 5-ton trucks, two of which are distillate-burning and are equipped with a patent gasifier, while the third burns gasoline, which costs about twice as much in the West as does the distillate. Though rated at five tons, they carry a load of four tons of ore, transporting it about two miles from the shaft mouth to the mill. The roads are typical mountain grades, running as high as 14% and are on a solid rock foundation. An illustration shows the nature of the country and the character of the roads. Though somewhat rough, they are fairly good highways for ordinary travel, but it was found that the sharp stones of their surface were ruinous to solid-rubber tires. Their effect was increased by the fact that the rear wheels of the trucks are equipped with double rims, so that while the inner rear tires track with the ruts, the outer ones receive the wear of the rougher surface. These rear wheels present to the road a surface of about 12 in. The tire trouble was partly overcome by the substitution of wood blocks for solid rubber. This wood-block tire, built with the end of the grain to the ground, wears down to a bristly cushion which is more elastic than might be expected, and withstands the wear of the broken rock fairly well. Such tires are good for about 600 miles on the road in question.

Loading at Mine Bins



Discharging at Mill Bin

Breakage of springs and other parts was another serious drawback, causing a double expense, since such parts cannot be so easily replaced as in the city, and while the necessary repairs are being made the trucks are out of commission, thus causing excessive delay and increasing fixed charges per ton. The rough roads were especially hard on the front springs, which would rebound so forcibly after a jolt that they would snap. This was rectified by the use of auxiliary spiral springs of heavy construction, which act as shock absorbers. The breaking of other parts indicates that a general strengthening of the average truck is desirable to allow for the unusually severe road conditions of a mining country.

In estimating the cost of operation, this repair work and laying off of the vehicle with consequent loss of time must be taken into consideration. It accounts to a great extent for the high estimate of about 40c. per mile run by the truck, or about 10c. per ton-mile. Although the cost of distillate is only about half the cost of gasoline, and

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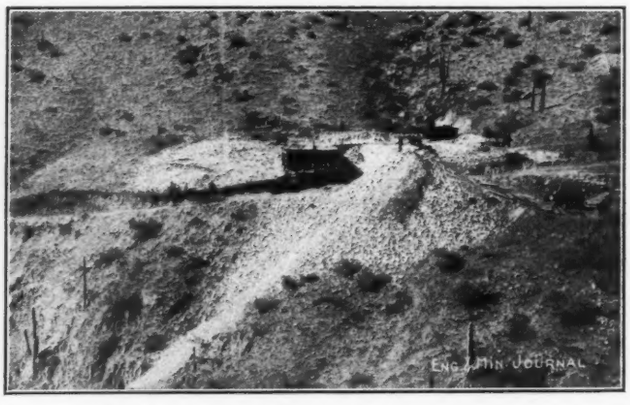
although the former is claimed to produce 25% more power, yet the results indicate that so much more distillate was consumed as to offset the supposed saving. As one gasoline-burning truck was operated alongside of two distillate-burners of equal tonnage and under identical conditions, this is an instructive test. The reason for this undue consumption of fuel cannot be definitely learned, but the fact remains that the fuel cost for the distillate-burners is about 25c. per mile, while the gasoline-burners cost somewhat less, in spite of the higher price of the latter fuel. It appears that special carburetor adjustments are needed in the high, light air of the Arizona mountains, and expert adjustment might solve this problem.

The loading and unloading of the ore was simplified so that no time or labor is wasted in that operation. The ore is received from bins, provided with chutes to discharge directly into the body of the truck; while unloading is accomplished by a self-dumping body. These arrangements are shown above. Only one man is required to each truck.

In operating over heavy grades it was found that the machines in use were geared too high to give the best



SHOWING LOADING BINS AND SIDEHILL ROAD

results. In one of these cars it was possible to rectify this by securing a nine-tooth sprocket wheel instead of a 14-tooth, but the other trucks are of a construction that does not admit of any change. The suggestion was made that a greater range between high and low gears would be advantageous in this hilly country, allowing for much more power on a heavy up-grade.

The trucks in use by the company at present are two Morelands and one White, all 5-ton vehicles, with four cylinders. The former have long-stroke motors delivering about 60 hp. The latter is rated at 45 hp. Each truck makes an average of six round trips daily of four miles each, a total of approximately 24 trips per day. After the installation of a steam road, now almost completed, between the mill and the shafts, the motor trucks will be used for delivering concentrates from the Calumet & Copper Creek mine to the nearest shipping point, Winkelman, Ariz., a distance of about 30 miles. This will involve still more problems, as the road runs through the San Pedro Valley over several very sandy stretches and there are two streams to ford.

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Mineral production of Alsace-Lorraine in 1912 included 20,083,238 metric tons iron ore; 3,538,722 tons coal; 72,541 tons salt; 137,243 tons potash salts; 49,176 tons petroleum; 5161 tons crude asphalt. All products show gains; that in iron ore was 2,328,667 tons, or 13.5%, over the previous year.

German Steel Production

The German Iron & Steel Union reports the production of all kinds of steel in the German Empire as below, in metric tons:

	Basic	Acid	Total
Converter	9,794,300	187,179	9,981,479
Openhearth	6,650,565	194,924	6,845,489
Direct castings	221,331	100,332	321,663
Crucible	.....	79,190	79,190
Electric	.....	74,177	74,177
Totals	16,666,196	535,802	17,301,998

The total increase over 1911 was 2,282,665 tons, or 15.2%. The gain was wholly in basic steel, both converter and openhearth making large gains. Crucible steel showed a decrease, but there was a considerable gain in electric steel. Basic steel was 96.3% of the total. By processes converter steel was 57.7% and openhearth 39.4% of the total.

The German Union reports pig-iron consumption in the German Empire as below, in metric tons:

	1911	1912	Changes
Production	15,579,299	17,868,909	I. 2,289,610
Imports	849,130	887,928	I. 38,798
Total	16,428,429	18,756,837	I. 2,328,408
Exports	7,523,915	8,406,373	I. 882,458
Consumption	8,904,514	10,350,464	I. 1,445,950

Imports in 1912 included 481,089 tons in the form of pig iron and 406,848 tons imported in steel and other finished forms, allowance being made for loss in conversion or manufacture. In the same way exports included 1,217,968 tons as pig, and 7,188,405 tons in finished forms.

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Rhodesian Mining Notes

The orebody at the Shamva mine has been penetrated at the fourth level for 45 ft. in width; the crosscut shows ore of an average value of 6.5 dwt., with ore in face. The railway from Salisbury has now reached the mine and the erection of the treatment plant will now begin. The plant will consist of 50 Nissen stamps of 2000 lb.; 10 tube mills; eight 50x8½-ft. sand tanks and five 35x10-ft. and five 45x10-ft. slime agitation tanks with a Butters filter plant. The plant is expected to treat 50,000 tons per month. If it does this, the stamps will have by far the highest duty in the world.

The ore reserves at the Lonely mine are returned at 174,500 tons of a value of 1 oz. 2.4 dwt. over the stope width. The mill return is nearly £4 per ton, but so far the mine has been disappointing as a dividend payer, owing to high working costs.

The Giant mine is now apparently approaching its end. Falls of wall rock in the shrinkage stopes have reduced the grade of ore milled and the output. The shaft will, however, be sunk 300 ft., and crosscuts driven in an effort to recover the orebody, which has proved one of the most profitable explored in Rhodesia.

I recently stated in these notes that the Wanderer mine had no future. Recently, however, a discovery has been made which may falsify this statement. An adit has entered an orebody, stated to have a width of 60 ft. and a value of 7 dwt. per ton. The ore milled recently had a value of only 2 dwt. This mine has milled over a million tons with practically no profit to the shareholders. The average number of natives employed on the mines of Southern Rhodesia for 1912 was 34,654, compared with 38,164 in 1911 and 37,824 in 1910.

The Black Oak Cyanide Plant, California

By Herbert A. Megraw

SYNOPSIS—A description of what is said to be the only all-slime mill in the State of California. Gold and silver occur in granite-diorite rock with sulphides. The ore is said to be similar to that of the Mother Lode which, up to this time has made little use of cyanidation. The mill is a rebuilt plant, the old stamps having been removed and modern 1250-lb. stamps installed. Tube mill is used to regrind the coarse sand. Oliver continuous filter is used and zinc dust serves as a precipitant. Costs are reduced to an extremely reasonable figure.

Near the town of Soulsbyville, in Tuolumne County, Calif., is situated the plant of the Black Oak Development Co., said to be the only mill at the present in the State of California which employs the total-sliming, continuous-agitation process of treatment. The property is in an agreeable district where climatic conditions are good and the natural surroundings pleasant.

The Black Oak Mill, Soulsbyville, Calif.

Gold Occurs in Quartz

The plant is near the town of Tuolumne, the terminus of the branch line railroad by means of which the district is reached, from Stockton, via Oakdale.

Gold and silver both occur in the ore of the Black Oak mine, and the proportion is 2 or 3 parts of silver, by weight, to one of gold. In this proportion the gold is, of course, by far the most important factor to be considered in the metallurgy of the ore, but, as will be mentioned later, the silver is in sufficient quantity to make advisable a special effort to recover a goodly proportion of it.

Most of the valuable metal is in quartz which occurs in a granite-diorite country rock, and sulphides contain the greater part of the silver and gold. As often happens in California ores, this gold does not seem to be chemically combined with the sulphides, but only mechanically, so that fine grinding liberates the greater part of it. The silver is, of course, largely in combination as sulphide, in which condition it is amenable to cyanidation after having been subjected to fine grinding.

Ore Similar to Mother Lode

It is noteworthy that the ore deposits of the Black Oak mine, and of the surrounding district similar in a general way to the mineral already described at Grass Valley, are said to be similar to the majority of ores in the mines on the Mother Lode, and identical with some of them. If this is true, the question immediately is suggested as to why the other Mother Lode mines, or at least some of them, do not make use of cyanidation, a process which has demonstrated its efficiency and economy on similar material. Mother Lode ores are still being beneficiated by old methods, amalgamation and concentration. While both of these systems are simple and cheap, it is undeniable that neither of them approaches cyanidation in the amount of recovery from simple ores.

Note—This is the sixteenth of a series of articles by Mr. Megraw on American cyanide practice. Previous articles appeared Nov. 2, Nov. 23, Dec. 14, Dec. 21, Dec. 28, 1912; Jan. 4, Feb. 8, Feb. 15, Feb. 22, Mar. 1, Mar. 8, Mar. 29, Apr. 5, Apr. 26 and May 17, 1913. The next article will deal with "The Gold Road Cyanide Mill, Ariz.," and will appear on July 5, 1913.

Some have informed me that Mother Lode ores are not treatable by cyanidation, while others have assured me quite as emphatically that they are. In view of results obtained at Black Oak and Grass Valley, the preponderance of evidence would seem to be in favor of the latter statement. Perhaps the experience of these two camps will be of value to those operators on the Mother Lode who desire to increase the efficiency of their installations.

Stamps Used for Crushing

Ore from the mine is first delivered to the mill bin which has a capacity of about 185 tons. Four Challenge feeders deliver it into the mortars of a 20-stamp crushing plant, each stamp weighing 1250 lb. and dropping 102 times per minute through 6 in. Mortars are of the narrow pattern designed for rapid crushing. Three of them are equipped with ton-cap screens having 19 apertures per inch, and the remaining mortar has a 6-mesh, square aperture screen. This coarse screen adds sufficient granular material to increase the efficiency of subsequent tube-mill work. Many of the recently constructed mills are adopting the system of varied feed for tube mills and the results thus far seem to have amply justified the practice.

The Black Oak mill was originally a 40-stamp plant, containing the old-style stamps of light weight, but it has been entirely rebuilt with new and appropriate machinery. There is still room for 40 stamps under the present room, in fact 20 of the original stamps are still there in a more or less dismantled condition. With further mine development all available space may be required.

Dorr Classifier and Tube Mill in Closed Circuit

Pulp from the stamps flows by gravity to a Dorr classifier of the usual type in which the slime is separated and taken directly to treatment and the sand is delivered to a tube mill for further grinding. This tube mill is 5x18 ft. and is of the type made by the Power & Mining Machinery Co. It is operated at 26 r.p.m. and requires 48 hp. to keep it moving. Imported pebbles are used, the consumption of which is 5 lb. per ton of ore crushed. The hardness of the ore is attested by this consumption of pebbles which is extraordinarily high.

Ground product from the tube mill is returned to the classifier by means of a bucket elevator, thus forming a closed circuit, the only exit from which is the slime in condition for agitation treatment.

Upon its exit from the classifier, the slime proceeds to a 10x20-ft. Dorr thickener, where a portion of the solution is decanted and a thickened pulp delivered of proper consistency for the subsequent cyanidation.

Agitators of the Pachuca Type

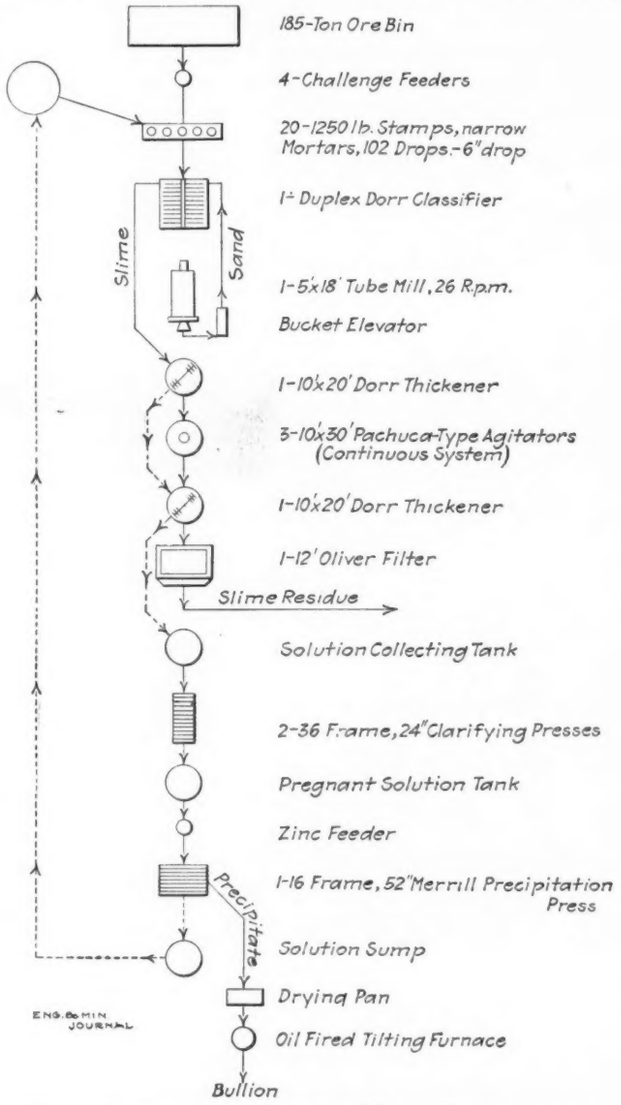
Slime treatment is performed in tanks of the Pachuca type of which there are three, each 10x30 ft. Passage of the pulp is continuous through these tanks and during the time of agitation the extraction of the contained gold is practically complete.

The Dorr thickener, which prepares the pulp for the agitation tanks delivers a pulp in which the proportion of slime to solution is about 1 : 1½. The thickener is operated at about one revolution in six minutes, and in common with these machines, requires an extremely small expenditure of power.

The material agitated is true slime, or colloid, only in small proportion, the major part consisting of extremely fine granular matter. About 78% of it is sufficiently fine to pass a 200-mesh screen, while 98 to 99% will pass a 150-mesh aperture. Pipe connections for the continuous passage of the pulp are 4 in. in diameter.

Filtration Is Continuous

Issuing from the agitation treatment in the Pachuca tanks, the pulp is received in a second Dorr thickener, identical in its dimensions with the one first mentioned. Just before reaching this thickener, the pulp is diluted with the overflow product of the first thickener and the mixture thickened to a point where the underflow of pulp



Flow Sheet of Black Oak Mill, Soulsbyville, Calif.

issuing contains solution and solid in a 1:1 proportion.

This thickened pulp is delivered to a 12-ft. Oliver continuous filter. The slime residue is dewatered and discarded and the solution, together with the overflow from the final Dorr thickener, is gathered in a collecting tank from which it is taken to the precipitation system.

Zinc Dust Used as Precipitant

For precipitation the Merrill system, using zinc dust, is followed. A special zinc-dust feeder drops the precipitant into the stream of pregnant solution going from

the tank to the suction of the pump, and the mixture is forced through a 16-frame filter press of the Merrill type. The frames of this press are 52 in. across the top and are triangular in shape as is usual.

Solution, after precipitation, is received in a sump from which it is pumped up to the solution storage tank for further use in the mill.

Precipitate from the press is partially dried in a drying pan, fluxed and melted in a tilting, oil-fired furnace. The accompanying flow-sheet diagram illustrates the metallurgical process followed in the mill and the principal machinery installed.

The Dry Slime Is Heavy

The Black Oak ore is hard, as has already been mentioned, and remains largely in the granular state even after continued grinding. The specific gravity of the dry slime in the condition in which it is subjected to agitation treatment, is about 2.8, a figure which is rather high in comparison with ordinary siliceous slimes, which generally contain a greater proportion of colloid matter.

TABLE OF COSTS AT THE BLACK OAK MILL, CALIF., BASED ON MILLING 2202.5 TONS

Supplies	Per Ton	
Rock crusher	$0.0121	
Batteries	0.0158	
Tube milling	0.0349	
Tube-mill liners	0.0266	
Classification	0.0039	
Refining	0.0195	
Repairs	0.0131	
Office and general superintendent	0.0042	
Assaying	0.0241	
Marketing Bullion:		
Control.....$10.45		
Treatment..167.38		
Express..... 25.25	0.0922	
Cyanide	0.2018	
Lime	0.0111	
Litharge	0.0507	
Zinc	0.0970	
Pebbles	0.078	$0.6850
Power and lights		$0.3500
Insurance		0.0200
Labor		
Rock crusher	$0.0453	
Tramming	0.0844	
Batteries	0.0968	
Tube milling	0.0184	
Classification	0.0192	
Agitation	0.0223	
Thickening	0.0223	
Pumping and elevating	0.0244	
Filtration	0.0246	
Clarification	0.0224	
Precipitation	0.0236	
Refining	0.0305	
Repairs	0.0523	
Office and general superintendent	0.0715	
Mill superintendent	0.0681	
Power and light	0.0165	
Assaying	0.0315	$0.6741
Total mill costs		$1.7291

The mill will treat about 100 tons per day of 24 hours, but at present the rate of crushing is near 85 tons daily. Average run of ore will contain a combined gold and silver value of $15 per ton in the proportions which have already been mentioned.

Of the gold, 97% is usually extracted without difficulty, and about 92% of the silver. Treatment solutions contain 0.2% KCN and 0.15% CaO. Lime is added at the batteries and in the agitators. Litharge is used as a source of lead for removing soluble sulphides from solution and is added at the tube mill in order to facilitate solution.

Low Chemical Consumption

The consumption of chemicals and supplies is low, as is usual when treating an ore whose value is largely in its gold content. The cyanide consumption is 1.0 lb. per ton; of litharge, 0.35 lb.; of lime, 3 lb.; of zinc, 1 lb., and of pebbles, 5 lb. per ton.

Seven men, excluding the superintendent, are required for mill operation, and 130 hp. is the average consumption of energy for moving the machinery. While the mill is small and handles only a limited quantity of ore, costs have been reduced to an extremely reasonable figure as is shown by the accompanying tabulated list of items. During the two months following that in which this report was made, a general reduction of costs has been accomplished, the total being reduced to about $1.61 per ton. The operators are fortunate in having an ample supply of water and conditions generally favorable for successful operation.

The St. Joseph Lead Co.

The report of the St. Joseph Lead Co. for the year ended Apr. 30, 1913, shows the production of lead from the company smeltery during the fiscal year to have been 66,847 tons. Of this amount, 32,109 tons were from purchased ore, 31,296 tons produced from the mines of the company, and 3442 tons were from stock at Herculaneum. The average price received for lead at East St. Louis was 4.35c. The net income of the company from all sources, after the payment of expenses and income charges and after setting aside $75,626 for depreciation, was $637,910.

During the period since its organization, the net income of the company has been $15,227,022, while the cash dividends have been $8,717,486. Since 1899 the net income has been $9,785,459, and the cash dividends paid have been $5,650,486. Since 1907, owing to the low price of lead, the excess of income over dividends has been only $765,637.

Many important improvements are under way at the mines and mills of the company, and it will probably be desirable to make still further extensions to its plant, but when the improvements now in course of completion are finished, there is likely to be a great addition to the net income of the company, and before undertaking further expenditures it is considered desirable to review the situation with respect to the ore reserve and plants of the company. The savings to be effected in the immediate future include those resulting from the large stopes in the mines, the abandonment of old steam plants, and the introduction of Hancock jigs and other modern machinery at Bonne Terre, and also from the mine, mill and power improvement at Leadwood. It is also expected that from the many new and systematic methods, the recently erected large flue at Herculaneum, and the new baghouse now in course of construction, material savings will be effected in the smelting department. The price received by the company for lead was $83 per ton in 1912, and $87 in 1913 (fiscal year).

In making advances to the Doe Run Lead Co. on the ore account with that company, it was felt that having provided for the increase of their own products by securing ample lead reserves and by building a new mill, it was for the business interests of the stockholders of the St. Joseph Lead Co. to further the increase in the ore output of the Doe Run Lead Co., as this output was and is handled at the smeltery of the St. Joseph Lead Co. and over the railroad of that company. At the time the advances were made, the Doe Run Lead Co. owned some stock in the St. Joseph Lead Co., but it was not thought that this stock ownership affected the advances. They were not made in any spirit of disregard of the law, and

have proved beneficial to the stockholders of the St. Joseph Lead Co. The indebtedness for these advances now amounts to $900,000, $100,000 having been paid by the Doe Run Lead Co. within the past two months. The ore output of the Doe Run Lead Co. for April, 1913, was over 4200 tons of lead concentrate, valued at approximately $179,000. It is considered of great advantage that the alliance between the St. Joseph Lead Co. and the Doe Run Lead Co. should be continued in some shape for the benefit of both concerns. The contract between them provides that the concentrate of the Doe Run Lead Co. shall be purchased at the market price, with a fixed charge of $6 for smelting and a deduction of 10% for loss. It also contains a provision that an average price for the year of not less than 4c. shall be paid for lead in the concentrate.

The combined net income of the St. Joseph Lead Co., the Mississippi River & Bonne Terre Ry., and the Bonne Terre Farming & Cattle Co., has been for the past year $858,915. The companies have paid to labor during the year $1,662,672; to managers, engineers and operating heads in salaries $221,077, and they have paid to general officers in salaries $89,658. They have paid in dividends to stockholders of the St. Joseph Lead Co. $597,300, and to individual stockholders of the Bonne Terre Farming & Cattle Co. $303, and have added to the combined surpluses $168,956.

The railroad conducts an interstate-commerce business and carries over two million tons of freight earning revenue per year and 275,000 passengers. In addition to the work of the St. Joseph Lead Co., it does all the work of the Doe Run Lead Co., including the handling of its ores from its shaft to the mill, and the handling of its concentrate to the smelter of the St. Joseph Lead Co. It also handles the business of the Desloge Consolidated Lead Co., which is brought to it over the railroad of that company; and a portion of the business of the St. Louis Smelting & Refining Co., which is brought to it by the electric line of that company; and at times some of the business of the Federal Lead Co.

The Bonne Terre Farming & Cattle Co. performs valuable service for the lead company and carries on all features of the business which relate to the surface rights of that company.

The condensed balance sheet of the company shows assets consisting of land, $6,725,342; buildings and equipment, $3,238,337; capital stock owned, $3,480,645; working and trade assets, $738,660; current assets, $1,980,435; due from affiliated companies, $319,430; deferred accounts, $227,156. The liabilities show capital stock, $10,000,000; Mississippi River & Bonne Terre Railway loan, due Oct. 1, 1931, at 5%, $2,447,931; current liabilities, $1,834,242; reserve for depreciation of buildings and equipment, $122,903; profit and loss surplus, $2,304,930.

The Mississippi River & Bonne Terre Railway balance sheet shows total assets of $7,102,990, and a surplus of profit $98,990. The Bonne Terre Farming & Cattle Co. shows total assets of $1,105,647, and profit surplus of $350,014.

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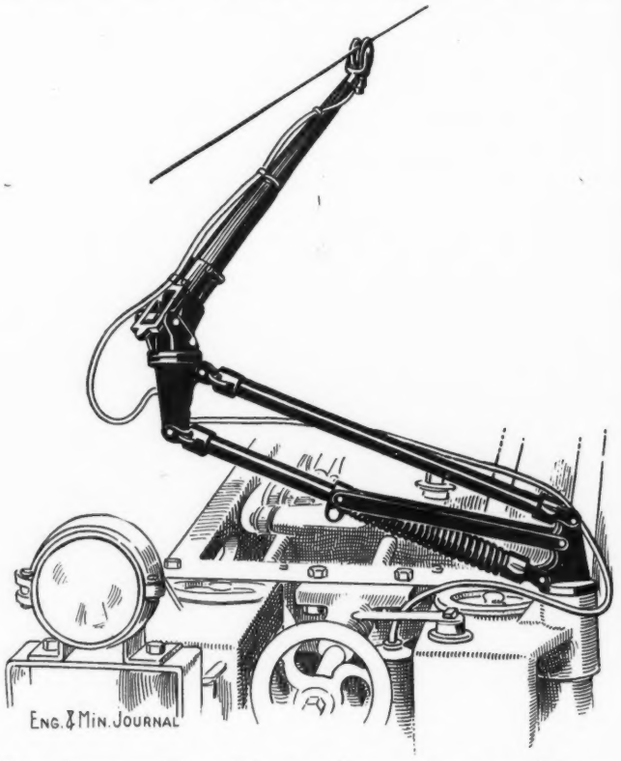
Boring for Oil in Sicily has been vigorously prosecuted for the last 18 months, according to "Daily Consular and Trade Reports," May 16, 1913. It appears that there are large quantities of oil near Nicosia in Catania, containing considerable quantities of bitumen, about 40 to 55% of petroleum, and free from sulphur.

New Type of Mine Trolley

A new trolley differing from the standard type has been recently devised, for which the following advantages are claimed: More nearly constant contact pressure; reversal possible in narrow passages; no interference with trailing cars; successful operation with trolley wire off the center of the track. The trolley consists of two members which operate in sockets. By means of a latch or pin at the lower socket, the lower member can be adjusted vertically and kept in a rigid position, and further, can be swung horizontally and fastened in any definite position required.

The trolley is designed to operate through a vertical range of six feet, allowing the height of the trolley wire above the rail to vary from 5 to 11 ft. The trolley-wheel pressure will vary from 18 to 26 lb. for these extremes, a much lower variation than is possible with the old type. This results in less liability to damage of the pole if the trolley leaves a low wire accidentally and springs against the roof, and the lower initial pressure possible decreases the wear on the wheel and harp.



NEW TYPE OF MINE TROLLEY SWUNG OVER FOR REVERSING IN NARROW PASSAGE

The trolley can be turned around in passages from four to six feet wide, as shown in the illustration; this is impossible with the old single-pole type. If fairly high trailing cars follow the motor, the long single-pole type may strike the nearest car when the trolley wire is low. This new type does not project much behind the locomotive, and so does not encounter this difficulty. The trolley will operate successfully where the wire varies from the center of the track four feet to either side. It can be applied to locomotives now in service.

The new trolley is placed on the market by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Penn.; type D-20 is its designation.

Time Studies and Air Consumption

By Andre Formis*

SYNOPSIS—Time studies of operations involving apparatus consuming compressed air have heretofore been hampered by the lack of a suitable air meter. A new airflow recording meter eliminates this difficulty. Studies of drilling operations and of pump performance are here presented.

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Since the introduction of compressed air in mining operations, many attempts have been made to produce a satisfactory means of measuring the actual air consumed by any given appliance. It is generally known that the builders of air machinery use a displacement tank to measure the air. This may solve the problem in the laboratory or the shop, but owing to the nature of the cumbersome equipment, such a device cannot well be moved from place to place, let alone to some restricted underground opening. Nor does the displacement tank register automatically a continuous line graph, depending for its position on time values and cubic feet as coördinates. Such a graph is unquestionably of greater value than the mere knowledge of actual air consumed. It permits of a time study that may point the way toward effecting material savings.

TABLE I. TIME STUDY OF DRILLING OPERATIONS IN DRIFT

	b Day Shift, Jan. 29		*c* Average of Seven Consecutive Shifts
	Total Time Consumed Minutes	Percentage of Total Time Consumption	Percentage of Total Time Consumption
Drill reciprocating	197	36.5	34.9
Changing steel	83	15.4	12.6
Shifting machine	95	17.5	*a* 13.9
Mucking for setup	58	10.7	16.4
Starting work morning and noon	22	4.1	5.7
Getting steel and water	12	2.2	3.2
Cleaning and charging	15	2.8	3.7
Blasting and tearing down	16	2.9	4.3
Blowing smoke	42	7.8	5.4

a 61.4% unavoidable.
b 40 ft. 5 in. of medium hard Kearsarge amygdaloid drilled with one 3½-in. piston machine. Cutting speed 0.205 ft. per min. Irregular rock bound steel. Flat holes in 7x10-ft. drift. Air pressure, 95 lb.
c. Average number of holes drilled, 6. Average footage, 42.3.

Present-day engineering efforts tend to analyze in detail all the processes in the production of tonnage. The most important factor is the time-labor element. If then a certain appliance, such as a rock drill using compressed air shows a high time-efficiency, as compared to one showing low efficiency, it can be seen that even a considerable increase in air consumption will be largely outweighed by the additional work done with the high time-efficiency machine, always provided that the two machines have similar drilling characteristics.

This is well illustrated by comparing the old style, heavy, 3⅛-in. piston drill (quite indispensable in certain hard formations) and the jackhamer drill. The latter may actually drill at a lower speed, but a material gain is made by the absence of time loss in rigging up a post and in taking down and moving the drill on the post for new holes. One man operates the jackhamer drill, compensating for a smaller footage drilled.

In order to obtain satisfactory time-study values underground heretofore, sole dependence was had on observations made by an individual with watch and notebook. There was always the question of quality and personal judgment, and furthermore the men operating the drill felt that they were under observation and the records thus made can hardly be classed as average performance.

*Superintendent, Ojibway Mining Co., Ojibway, Mich.

Air Recording Meter Now on the Market

The General Electric Co. has lately put on the market an airflow meter, which measures the cubic feet of air consumed and records it graphically on a moving strip of paper. It can be seen that an observer's notes are accurately checked by such a meter, which is tireless and will run for a whole week without attention. A continuous record over a week of day- and night-shifts forms a basis for calculating a fair average shift's performance. One of these meters was installed at the property with which I am connected, and various air-consuming devices were measured. The most important were air drills, and time-studies were made in connection with these.

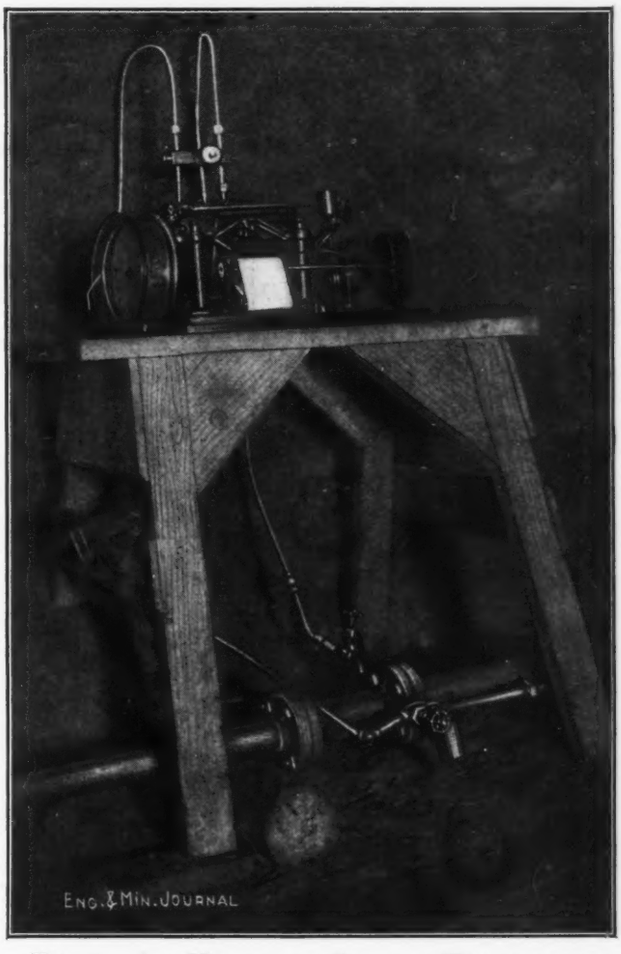

Fig. 1. Air Meter and Gage on Underground Main

Fig. 1 shows a view of the meter with cover removed, connected to the air main on the 1900-ft. level, No. 2 shaft. One drill only was operating on this line on two 9-hr. shifts. A recording air-gage was also installed to ascertain the exact air pressure at any time near the drill. Fig. 2 is a copy of the record of the day shift

Jan. 29, 1913, illustrating the cycle of work from one blasting to the next. The corresponding record of air pressure is shown in Fig. 4. The time study made in connection with the graph, Table I, illustrates the progress of the work. It will be seen that the time-consumption items may be divided into avoidable and unavoidable,

TABLE II. DISTRIBUTION OF COSTS FOR DRILLING IN DRIFT, JAN. 29, 1913

	Amount per Shift	Cost per Foot Drilled
2 miners @ $2.87	$5.74	$0.1420
Blacksmith @ $2.75 and helper @ $2.00	0.47	0.0116
Air, including labor, oils, etc., @ $108.79 per month	2.08	0.0518
Drill repairs @ $0.40 per shift	0.40	0.0099
Total	$8.69	$0.2153

the latter inherent in the operation. Such are the time that the drill is reciprocating, the time consumed in changing steel and that consumed in shifting the machine on the drill post. The remaining factors may be reduced or perhaps avoided if the additional footage drilled will pay for the additional labor required to do this work. Table II gives a distribution of the costs for the shift in question.

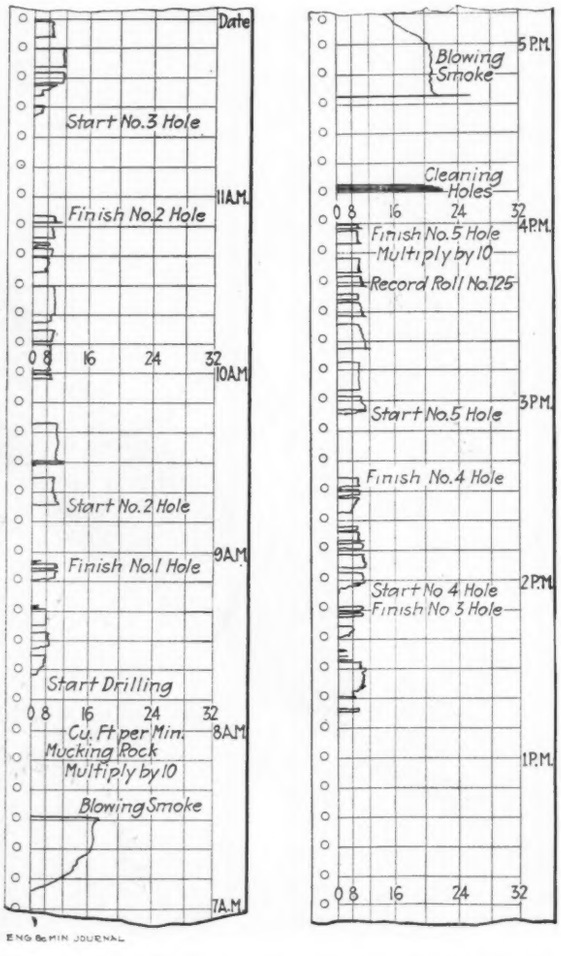

FIG. 2. AIR CONSUMPTION BY SHIFT'S DRILLING

DIFFICULTIES ENCOUNTERED WITH MINERS

In stoping, conditions are somewhat different and more actual drill-reciprocating time should be obtained, but this may be pushed too far and it will be found that holes are drilled in excess of those required to break the tonnage. A larger amount of explosive will also be used. If in this case the men are reproved or fined for drilling what may appear to be excess holes, especially if this footage forms a contract basis, there is always the question of judgment and for harmony's sake a board of arbitration may be advisable. There may also result some dissatisfaction among the men, making it hard to obtain good labor; finally the men may be led to neglect the trimming of the hanging wall, thus endangering the trammers on the levels.

It is thus apparent that a number of points must be considered at all times in order to equitably reduce the time-labor factor underground. It is also a fact that what may produce economical work in one property cannot be applied indiscriminately everywhere.

The study of these conditions is the logical field for the efficiency engineer, but he must be reasonably free from interference and be given enough authority to make his work possible and profitable.

The air meter was also used to investigate the air consumption of a small, single-stroke 7x3½x7-in. plunger pump. The water was pumped a height of 250 ft. on an angle of 33°, the size of the suction and discharge lines being according to the manufacturers' specifications. The strokes per minute were counted and noted on the chart at the corresponding air-flow line. It was found that at 130 strokes, 85 cu.ft. were used. The horsepower drawn from the boilers to compress this amount of air was 13.1 hp., according to the manufacturer's catalog. The theoretical power required to pump the amount of water is 2.56 hp., without friction or leakage losses. The electrical power required to pump this amount would be conservatively four boiler horsepower.

Fig. 3 has been plotted from a set of observations. It shows that the most economical speed is about 75 gal. per min., corresponding to the point marked *X*. This happens to be about three times the water to be handled per day; thus it determines the size of the sump, and the number of attendants required to run a given number of pumps. Of course, the economical point is determined by such considerations as leakage in air valve, slippage in water end and water valves, moisture in compressed air inducing freezing, and size of suction and discharge pipes. This confirms the well known fact that pumping by air is uneconomical. At times electric pumping would entail considerable expense, but for permanent installations any reasonable additional cost will be repaid in a short time.

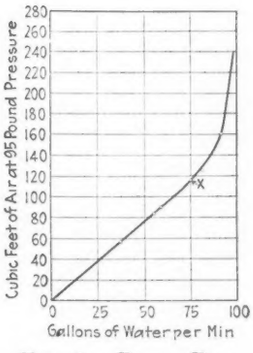

FIG. 3. PUMP PERFORMANCE AS GIVEN BY AIR METER

FIG. 4. RECORD OF AIR PRESSURE DURING DRILLING

It may be stated that the air meter can be used on mains from 2 in. to almost any size. It is only necessary to install the nozzle plugs in the mains; the meter can be carried to that point, proper connections made with the nozzle-plug pipes, and a record roll of proper capacity placed on the meter drums.

The Welfare Work of the Steel Corporation

The following notes are taken from Mr. Farrell's recent testimony in the Government's suit for the dissolution of the Steel Corporation:

Since 1910, the corporation has spent about $2,300,000 in welfare work, including sanitation, playgrounds, club houses, etc. The company has spent $70,000 in installing cooling systems in sheet mills, reducing the temperature of the mills from over 100° to 65°.

"A man around a blast furnace," Mr. Farrell said, "is on duty and is paid for 12 hours daily. He actually works six hours and the rest of the time loafs in rest houses provided by the company, smoking and reading. When I was working in the mills we sat on the cinder piles. About 2% of the corporation's employees work around blast furnaces. Each plant of the corporation has an emergency hospital where trained nurses, and in some cases electric ambulances, are in attendance."

Mr. Farrell next spoke of the "rescue corps" connected with the ore and coal mines. He said that he has thousands of personal acquaintances among the workmen of the corporation and has worked in the mills with a large number of them.

The corporation has a corp of bacteriologists who examine the drinking water in the mills. Last year the men employed by the corporation in the Connellsville region made 5300 gardens and raised garden truck valued at $250,000, or an average of $50 per man. The corporation furnishes the seeds and men to plow the ground. The corporation builds houses for employees, when necessary. In 1911 and 1912 the corporation spent $1,363,367 on safety devices and since 1906 the fatal accidents among employees have been reduced 40%. In other words, the safety devices have saved the lives of about 8000 men.

"The safety devices adopted by the Steel Corporation," said Mr. Farrell, "have done wonders toward increasing the efficiency of the men. We even have cooking schools to teach the foreigners to cook in a scientific and economic manner. We do not look upon this work as a philanthropic proposition, but rather as a means of reducing costs, keeping up wages and increasing efficiency and output."

The pension plan of the corporation provides that any man over 60 years or woman over 50 years of age, who has been employed by the corporation for 20 years, is retired on pension. Any employee of 15 years' standing, who is totally incapacitated, also receives the pension. In 1912, 3633 pensions were granted, the average age of beneficiaries being 63.39 years and the average length of service 29.14 years. The average pension last year was $20.30 per month. The relief paid to employees and families from 1910 to 1912 was $5,304,321.

Since the Steel Corporation instituted the stock subscription plan for employees in 1903 and from then until the first of this year, employees have subscribed for a total of $30,586,400 of preferred and $10,099,600 of the common issue. Since 1903 the corporation has paid $5,728,604 in special compensation to employee holders of stock.

The seven-day working week has been abolished by the corporation. Before organization the seven-day week was universal in the steel and iron mills, having been a custom for 35 years. On Apr. 23, 1907, the finance committee of the Steel Corporation passed a resolution providing that the seven-day working week be abolished wherever possible, and as little work done on Sunday as possible. The next step to this end was a telegram from Judge Gary on Mar. 18, 1910, to presidents of the subsidiary companies insisting that no Sunday work be done and that "there must be 24 consecutive hours of rest in each week." Another resolution adopted by the finance committee, on Apr. 12, 1912, called for the abolition of all Sunday work and the shortening of the "long turn," which came at the end of the week and in some cases was more than 12 hours.

Large numbers of the laboring men have requested to be allowed to work seven days a week, but Judge Gary refused. In 1912 the corporation lost 4000 skilled mechanics who went to competitors allowing Sunday work. Blast, openhearth and bessemer furnaces must be operated or kept lighted at all times, but if a man works on Sunday he is required to lay off on a weekday.

Mason Valley Mines

The mining property of the Mason Valley Mines Co. consists of seven claims and a fraction in the Mason mining district, Lyon County, Nev., according to the report for the year ended Dec. 31, 1912. No new property was acquired during the year.

An air-compressor plant, situated at the mouth of No. 4 tunnel, consists of one Ingersoll duplex compressor, capacity, 1216 cu.ft. per min., driven by a 200-hp. induction motor. An auxiliary compressor, of the Ingersoll type, of 576 cu.ft. capacity, has been moved from No. 3 tunnel level, and installed beside the large compressor. This machine is driven by a 100-hp. induction motor. A motor-generator set, of 50 hp. capacity, in the compressor building, is used for supplying the direct current for mine locomotives. Additional stoping drills have been added to the drilling equipment, and a 7x10-in. duplex hoisting engine has been installed in No. 4 tunnel level for the purpose of prospecting and developing the ore below this level.

The crushing plant consists of one Blake-type crusher with a 15x30-in. opening, driven by a 50-hp. induction motor. Ore is delivered from the crusher by a conveyor belt to the storage bins, from which it is drawn into the tramway buckets. Ore-bin capacity at the upper tramway terminal is now being increased by the addition of three bins of 300 tons' capacity each, this addition having been made necessary on account of the variety of ore and fluxing material that is being shipped.

The aërial tramway is of the Otto friction-grip system, and has a rated capacity of 100 tons of ore per hour. The line is 6250 ft. in length, with a total fall of 600 feet.

Improvements of the electric-haulage equipment have been made by the addition of a second four-ton Jeffrey electric motor and 30 ore cars. There are now two four-ton Jeffrey electric locomotives and 42 heavy steel ore cars of 24 cu.ft. capacity, equivalent to 1½ tons per car.

An electric pump has been installed at the lower tramway terminal, near the town of Mason, and water is secured from the Mason townsite well and pumped through 8000 ft. of 2-in. pipe to a 50,000-gal. tank, located above the mine, from which point water is distributed with sufficient pressure for fire protection. This installation has dispensed with the necessity of hauling water by team.

Electric power is secured from the Truckee River General Electric Co., operating plants along the Truckee River. The transmission line is about 80 miles long. All the machinery in the mine is operated by electric power, and with the exception of a few days' shutdown on account of the burning of one of the company's transformer stations, the supply of power has been satisfactory.

Ore shipments were started from the Mason Valley mine on Jan. 5, 1912. Previous to this date the property had been well developed and equipped to produce the tonnage which might be required to supplement the tonnage of custom ores. The amount shipped has come principally from the three stopes which were started above No. 3 tunnel level during the previous year.

A number of irregular bunches of limestone have penetrated the ore in places, lowering the grade of shipments, but supplying a portion of the lime required to make

a proper slag. In stoping these orebodies by the shrinkage system, it has been found that in place of three separate ore chutes, there is one continuous orebody from 800 to 900 ft. in length, the greater portion of which will be smelted at a profit. Mining and stoping have recently been started on No. 1 and No. 4 tunnel levels.

The limestone ore has been quarried from the surface, the ore being delivered through chutes to a pocket on No. 4 tunnel level, 400 ft. below. This tonnage has been of value in making a suitable blast-furnace charge. Development work indicates the existence of a large tonnage of this material.

Mining operations have been governed largely by the requirements of the smelter, shipments having been made to make proper mixtures with the custom ores received. The Mason Valley mine has supplied all fluxing material required in the smelting operation.

A crosscut was started east from the lime stope above No. 1 tunnel level last October, and was driven to prospect an east vein outcropping on the surface. Ore was encountered at a point about 200 ft. from the lime stope and consisted of 16 ft. of carbonate ore, assaying 2% copper. A crosscut was started east in No. 1 level for the purpose of exploring the ground at greater depth under the lime crosscut. After drifting 20 ft. a 10-ft. shoot of ore, assaying 3% copper, was encountered. Drifts are being run north and south on this ore at the present time.

During the year, 2216 ft. of diamond drilling was done, and this has furnished information which will be of value in further developing the mine. Ore and limestone, after crushing, are transported to the railway, a distance of 1¼ miles, by aërial tramway operated by gravity. From the lower tramway terminal bins the ore is delivered to railway cars and transported to the smelter, 16 miles distant.

Buena Tierra Mining Co.

The report of the Buena Tierra Mining Co.,Ltd., operating property in the Santa Eulalia district of Chihuahua, Mexico, shows that operations for the past year were carried out under difficulties. At the beginning of the year, there was a strike of all the miners in the district, which was shortly followed by the outbreak of the present revolution in the northern part of Mexico. Great unrest was caused among all workmen, and especially so in the immediate vicinity of the town of Chihuahua, which was the headquarters of the revolutionary forces until the arrival of National troops in July. The arrival of these troops did not improve conditions, as the revolutionists simply retired to the north, destroying the railroads, with their roadways and rolling equipment, connecting with El Paso. This made it difficult to secure supplies for mines and smelteries, with the result that the latter were closed a part of the time, and when running only succeeded in working at part of their capacity.

During the year the mines shipped to the smeltery 30,085 tons, having a net return of $256,014, or $8.51 per ton, with an average content of 8.65 oz. silver and 15.1% lead. The cost per ton for mining was $1.33; for development, $1.08; general expense, $0.54; taxes, $0.11; sorting and transportation, $0.86. Total cost amounted to $120,467 or $3.92 per ton. The sum of $145,887 represents total profit.

The total development during 1912, including drifting, raising and sinking was 4806 ft. of work done in the limestone, in addition to which there were 2084 ft. of work done in orebodies, partly in limestone and partly in ore. This was done in order to facilitate the extraction of the ore and is hence chargeable to ore breaking.

Total ore reserves at the end of the year amounted to 301,150 tons, with an average content about the same as the ore shipped to the smeltery during 1912, or 8.5 oz. silver and 15 per cent. lead. The net profit amounted to $135,547, or approximately $4.51 per ton.

Temiskaming Mining Co.

The annual report of the Temiskaming Mining Co., Ltd., covers the calendar year 1912. The production for the year was 497,873 oz. of silver, obtained by hand sorting, and 744,370 oz. from the mill. Returns from ore sales and shipments were $762,654, increased by miscellaneous items to $776,076. Mining costs were $169,915; milling costs, $47,745; smelting costs, $56,580; general expenses, $58,462; increased by other surface charges to $362,460; leaving a net profit on the year's operations of $413,616. Dividends of $300,000 were paid during the year. There were hoisted during the year 31,449 tons of ore, of which 4503 tons were sorting ore and 26,946 tons were milling ore. The mining costs on this tonnage were: Prospecting, $1.55; development, $1.02; mining, $2.72. Development work included 2688 ft. of drifts, 1306 ft. of crosscuts, 87 ft. of winzes, 527 ft. of raises, and 37 ft. of shafts. The mill treated 40,056 tons of 22.6-oz. ore at a cost of $1.72 per ton, or 9.3c. per oz. A recovery of 82.1% was obtained. The 890 tons of concentrates produced averaged 836 oz. per ton. The shipments for the year contained 13,219 lb. of copper, for which $935 was received.

Production costs based on the 40,056 tons of ore treated and 1,242,243 oz. of silver produced, were: Mining, 13.4c. per oz.; milling, 4.0c.; smelting, 4.6c.; general expense, 4.6c.; increased by other miscellaneous surface expenses, etc., to 28.8c. per oz., and reduced by sundry revenue accounts to 28.4c. Toward the close of the year prospecting disclosed several new bodies of promise.

Board of Directors, A. I. M. E.

In this issue are presented the photographs of the Board of Directors of the A. I. M. E., which was elected at the annual meeting in February, 1913, in accordance with the new constitution, adopted at the same meeting. This constitution provides that the business, financial and other interests of the Institute shall be managed by and under a board of directors, consisting of the president, two past presidents, six vice-presidents and 15 directors, to be elected by letter-ballot of the entire membership. Full details regarding the actions of the Institute regarding this matter have already been given in the JOURNAL. The present board of directors replaced the dual system of management by a council and a board of directors which was formerly in force.

Dividends of the Rio Tinto and Tharsis companies amount to 50 and 20%, respectively, for the last fiscal year.

The Board of Directors, A. I. M. E.

1—**Charles F. Rand,**
President, 1913–'14.

2—**Charles Kirchhoff,**
Past President, 1913-'14.

3—**James F. Kemp,**
Past President, 1913–'15.

4—**Benjamin B. Thayer,**
First Vice-Pres. 1913–'14.

5—**George C. Stone,**
Treasurer, 1913–'14.

6—**Sidney J. Jennings,**
Vice-President, 1913–'15.

7—**Waldemar Lindgren,**
Vice-President, 1913–'14.

8—**Karl Eilers,**
Vice-President, 1913–'14.

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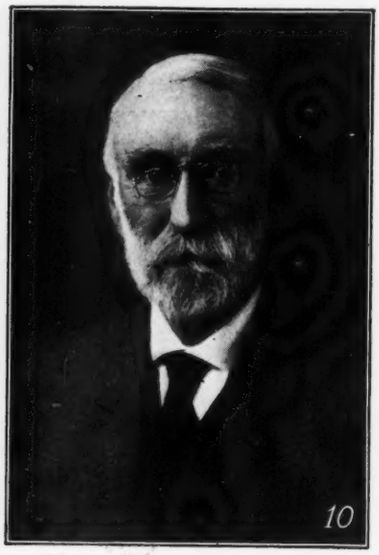
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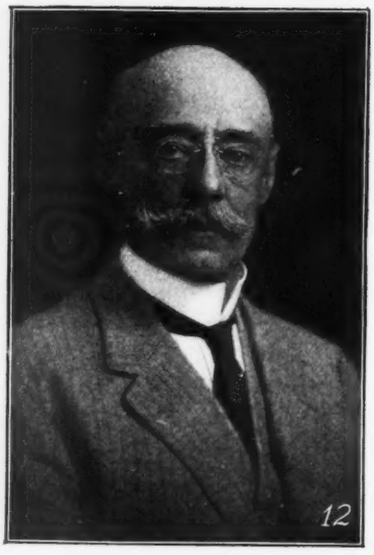
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9—**Thomas H. Leggett,**
Vice-President, 1913–'16

10—**James Douglas,**
Director, 1913–'14.

11—**Fred W. Denton,**
Vice-President, 1913–'16.

12—**Albert R. Ledoux,**
Director, 1913–'14

13—**James Gayley,**
Director, 1913–'14.

14—**Edmund B. Kirby,**
Director, 1913–'15

15—**Charles W. Merrill,**
Director, 1913–'14

16—**C. Snelling Robinson,**
Director, 1913–'14.

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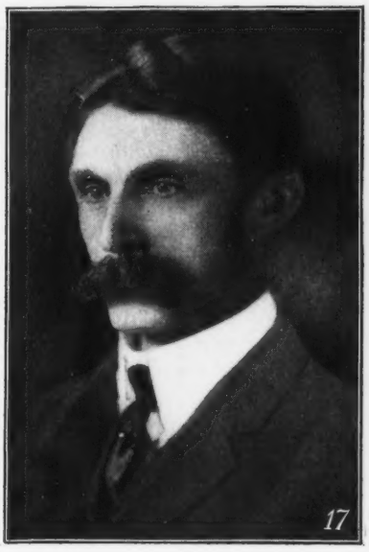
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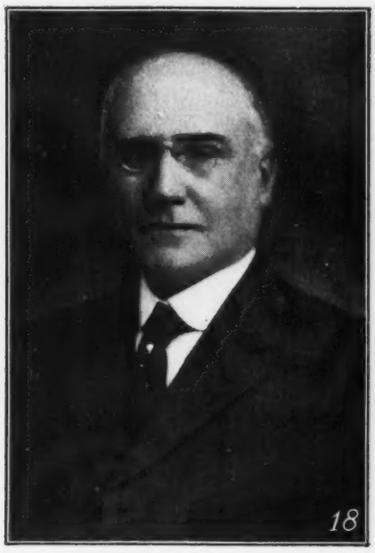
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17—**Joseph A. Holmes,**
Director, 1913–'15.

18—**Edward L. Young,**
Director, 1913–'15.

19—**Robert W. Hunt,**
Director, 1913–'15.

20—**John H. Janeway, Jr.,**
Director, 1913–'16.

21—**John W. Finch,**
Director, 1913–'16.

22—**Joseph W. Richards,**
Director, 1913–'16.

23—**L. D. Ricketts,**
Director, 1913–'16.

24—**E. P. Mathewson,**
Director, 1913–'16.

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Mount Morgan Gold Mining Co.

The report of the Mount Morgan Gold Mining Co., Ltd., for the half year ended Nov. 30, 1912, states that the total revenues for that period amounted to £640,712. Expenditures were £65,420 to the Queensland government, £206,520 for wages, etc., and £115,645 of other expenditures. Surplus revenue for the half year was £253,126. One dividend of £50,000 was paid. Of the remainder of the surplus revenue, £24,707 was applied on depreciation of plant and machinery, £20,000 on replacement of stores and stock, and £100,000 on rebuilding. The item for rebuilding is an installment toward the cost of new furnaces and a rearrangement of the whole plant.

There were mined during the six months, 66,000 tons of high-grade ore and 30,000 tons of medium-grade ore, and 27,000 tons of low-grade ore from the Mount Morgan mine. Development at that mine amounted to 122 ft. of drifting, 26 ft. of recessing, and 303 ft. of sinking. Reserves remain at 1,433,000 tons of high-grade ore and 1,997,000 tons of medium-grade ore. At the Many Peaks mine, there were mined 53,064 tons of ore. Development at this mine amounted to 570 ft. The copper smeltery handled 172,424 tons of ore and obtained 5004 tons of copper and 62,553 oz. of gold, the average copper content being 2.9% and the gold, 7.25 dwt. per ton.

The plant at the copper-reduction works, which has been in commission for the past seven years, cannot be made suitable for pyritic smelting, and, therefore, a new plant has been planned, of which the cost will be approximately £150,000. Experiments are being conducted in concentrating the siliceous ores. Prospecting has been prosecuted on two coal mines in Central Queensland on which options were held and it is hoped that by the use of coal from these mines the cost of coal and coke may be materially reduced.

Old Dominion Annual Report

The annual reports of the Old Dominion Copper Mining & Smelting Co. and the United Globe Mines, of Globe, Ariz., are published with the report of the holding corporation, the Old Dominion Co. The Old Dominion Copper Mining & Smelting Co. extracted during the year 93,592 tons of 6.43% smelting ore, 106,232 tons of 3.15% concentrating ore and 1357 tons of silica lining carrying 2.7% copper. The average grade was 4.67% as against 5.84% for the previous year. The mining cost was $4.55 per ton as against $4.18 for 1911.

Development consisted of 10,964 ft. of drifting, 4092 ft. of raising, and 203 ft. of sinking. The amount of water pumped increased about 13%, the average daily flow being a little short of 4,000,000 gal. Of the total flow for the year, 732,000,000 gal. were sold to the Miami Copper Co. Power costs in 1912 were $64.04 per horsepower year, a reduction of about 24% from 1911, due largely to a new contract for fuel oil.

The concentrator, in addition to the mine ore, handled 60,638 tons of custom ore. The average copper content of both classes was 3.37%. The concentrating cost for the year was $0.753 per ton, a decrease of about 25% from the previous year. These lowered costs together with the higher price of copper prevailing made it possible to handle lower-grade ores at a profit. It is hoped to have the new crusher and sampler in operation by September and the new concentrator itself a few months later. The smeltery handled 306,086 tons of ore at a cost of $2.304 per ton and produced 27,353,243 lb. of copper, 143,011 oz. of silver and 3202 oz. of gold. Of the smeltery production 16,534,000 lb. of fine copper, 42,751 oz. of silver and 583 oz. of gold were from Old Dominion ore, the balance was from custom ores. There was realized on the Old Dominion ore, $2,751,899, increased by profits on custom ores and by miscellaneous earnings to $2,888,204. After deducting expenses the net earnings were $1,004,186. Dividends of $729,000 were paid.

The United Globe Mines during 1912 extracted and shipped 188,254 tons of oxide and sulphide ores, concentrating ores, converter lining, silica and slag, of which the average tenor of copper was 3.25%. The amount of metal obtained from the total shipments was 12,252,073 lb. of copper, 124,362 oz. of silver and 789 oz. of gold. Development work included 3226 ft. of raising, 11,393 ft. of drifting and 321 ft. of sinking, in addition to which the Kingdon shaft was concreted, the Grey shaft retimbered, and about 720 ft. of repair work done on the third and seventh levels of the Grey shaft and the lower tunnel of the Buffalo mines. The amount received from ore sales was $1,309,214, increased by sales of lime rock and by interest received to $1,319,451. After deducting expenses the net earnings for the year were $619,476. Dividends of $460,000 were paid during the year.

The Old Dominion Co. (holding corporation) reports dividends on stock owned of $1,159,244, interest receipts of $28,103, and a net income of $1,180,235.

Chinese and Indian Steel

Perhaps the most dangerous competition which the American concern faces is the plant recently installed at Sini, in India, not far from Calcutta, says James A. Farrell. This plant is producing pig iron at $5.40 a ton —paying its blast-furnace men 3c. per day—and for 48c. it may be shipped to Calcutta, and there loaded for Pacific ports. The vessels engaged in this trade are principally sailing ships which plan to return from British Columbia with wheat and lumber, and they make a rate of from $5 to $6.50 a ton. For some time they have traded with Japanese ports and British Columbia. At the present time, one of these ships from Calcutta is on the way to San Francisco loaded with the first cargo of pig iron from that source to be landed within the Golden Gate. The freight was $5.50, and under the new tariff the iron will cost, laid down, something like $12 a ton, whereas the price now prevailing on the Pacific Coast is about $21.50.

At the Pan Yan Works, in China, opposite Hankow, similar conditions prevail. One pound sterling, or about $5, will pay 30 men to labor for a day around a Chinese blast furnace. Nevertheless, his engineers tell him, added Farrell, that the bridge-building plant there is as efficient as any in America.

However, in spite of the fact that the Chinese mills are running full time to provide the rails for the extensive building going on in the new republic, and are turning out a good product, the United States Steel Corporation continues to supply a large tonnage of rails, because of the present inability of the local mills to keep up with the demand.

Semi-Pyritic Smelting in Mexico

By R. Stephen Pratt*

SYNOPSIS—An ore of complex composition was to be smelted in old-style equipment, but practice showed that such a high percentage of coke was required that no profit was obtainable. Further experiment proved that by following pyritic-smelting methods the coke consumption was reduced to less than 4% and the process made an economical success.

Some time ago I was called upon to take charge of and place in operation the smelting plant of the Minneapolis Copper Mining Co., embracing a group of several claims, known as the Archipelago, situated about 35 miles southwest of the town of Cumpas, in the Moctezuma district, of Sonora. The nearest railroad point is Nacozari, about 65 miles distant, the southern terminus of the Ferrocarril de Nacozari. All supplies for the mine and smeltery have to be packed in on burro-back the whole distance on account of the poor roads, and all shipments of ore or matte have to be handled likewise. It will be seen that the company is handicapped by a serious problem of transportation, and any suggestion which promises relief cannot be disregarded. I take pleasure in giving herewith the results obtained at the property during the last two months by making use of the principles of pyritic smelting, which are forcing themselves more and more upon the attention of modern metallurgists wherever the conditions permit of their use, especially at isolated properties like the one under discussion.

Ore Is a Complex One

The following is the average composition of the ore as determined from a comparison of a number of assays: Cu, 10%; Fe, 25; S, 30 to 35; SiO_2, 14; Al_2O_3, 4; Zn, 1.5; As, 4; Sb, 0.5%; Au, 0.25 oz.; Ag, 3.50 oz. per ton. Mineralogically, the ore is a mixture of uncertain composition. It consists for the most part of pyrite and pyrrhotite, with considerable intermingled chalcopyrite, tetrahedrite and enargite. Indeed, it is possible to find all these minerals, as well as occasional specimens of galena and sphalerite. I may add that the proportions of sulphur, arsenic and antimony vary greatly, but their combined percentage averages close to 40%. The gangue rock is a decomposed diorite high in alumina, and the ore is seemingly frozen to it, so that a great deal of waste material has to be mined with the ore.

Old-Style Equipment

The smelting equipment consists of a 48-in. diameter, 8-tuyere, water-jacketed Fraser & Chalmers circular copper furnace of the type so much used in Arizona during the early days of the copper-smelting industry. The furnace is supplied with blast by a No. 4½ Baker positive-pressure blower, belt driven by a 20-hp. Fairbanks-Morse gasoline engine. Circulation water is supplied to furnace and engines from a tank system, the water being raised from the main shaft by bailing bucket to the upper tank and is supplied by gravity as needed to the plant. From the plant it passes to another tank and is lifted to the first tank for re-use by a small centrifugal pump, belt driven from another small Fairbanks-Morse gasoline engine. The gasoline installation has so far been found satisfactory and economical. The furnace is equipped with the usual forehearth and assortment of matte and slag pots. The installation being small and labor cheap, everything is done by hand when possible, including the spalling of ore and fluxes, as well as furnace products.

Trial Run Showed High Coke Consumption

The first trial run was made with the ore just as it came from the mine. On account of the large percentage of alumina in this unsorted ore (at times as high as 6 to 7%), I was of the impression that pyritic or even semi-pyritic smelting would be impossible, so to be on the safe side at all times, the first run was figured on the basis of 15% coke. During the run I found that even this large amount was not, at times, sufficient and the coke charge at intervals reached 18%. According to the character of the ore, it was necessary to use small amounts of a good iron flux from a near-by gossan outcrop; or else some pure quartz, of which we also had a handy supply. It will be understood that the ore was not uniform, as we had no bedding system, and it was necessary to use much caution in adding the fluxes. No lime was at this time available, but we succeeded in producing a good, clean and fluid slag. The grade of the matte was a serious trouble, and try as we might to change it, we were not able to do so. It persisted in maintaining an average of 25% for several days, although changes were made in the height of ore column, volume of blast, and even some partially roasted ore was added to the charge without seeming in the least to affect the final result. It was soon seen that such an exorbitant coke charge and the production of such low-grade matte would never permit a commercial success. But the use of the ore direct from the mine necessitated the high coke charge in order to give the proper fluidity to the highly aluminous slag produced. It was decided to have the ore picked over before smelting and the highly aluminous diorite gangue rock, thrown out. This was a commercial possibility if a saving of coke could be made, as labor was cheap and rather efficient. A good quality of lime flux entirely free from alumina had in the meantime been found in the neighborhood, so I decided to try the effect of diluting the aluminous slag with various proportions of lime and siliceous fluxes. The next run was made with these conditions, and I found the slag to be very much cleaner and more fluid, although the coke charge was cut to a little under 10%. The furnace was at all times in good running order, but the best matte produced was not over 28% in copper tenor.

Pyritic Smelting Not Considered at First

Up to this time we had favored a rather high charge burden under mistaken impression that we could get the best results under the old process of coke smelting, and had paid practically no attention to the possibilities of the pyritic process, with disappointing results. In the

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next run it was decided to try out thoroughly the semi-pyritic process. The charge burden was appreciably lowered, but the coke was allowed to remain at the old figure of 10% and we charged, the same as before, with clean ore and the proper amount of fluxes to give a clean slag of the proper composition. After several hours' operation on this charge, it was found necessary to reduce the coke repeatedly, as the furnace became too hot for safe running. We found that we were able to use less than 4% coke on the charge and make a matte considerably above 35% in copper content. As coke delivered at the mine costs in the neighborhood of $30 or $35 per ton, it can readily be seen what a difference in profits the reduction of coke used actually makes.

PYRITIC PROCESS PROBABLY MORE WIDELY APPLICABLE

In conclusion, I think that I can safely say that with proper blast equipment, the coke charge can still be considerably cut until the practice approaches that at Keswick, Calif., and that the pyritic process of smelting successfully solves the problem of those copper mines so situated as not to have proper transportation facilities, when the ore is of such a character as to permit of its use. I further believe that it is applicable to a great many more ores than at present thought amenable to its principles, and if so it will aid in the development of a great part of Mexico not at present supplied with requisite transportation. I wish to acknowledge the help I have obtained by study of the writings of Lewis T. Wright, on his experiences at Keswick, in smelting pyritic ore without coke. These writings supply data on the process which it is impossible to obtain elsewhere, and it is to them that I attribute in a large measure the success of the operations herein described.

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Chinese Antimony Production

In a paper before the Society of Chemical Industry, Mar. 3, 1913, W. E. Schoeller made the following statements concerning Chinese antimony smelting:

At Chang-sha and also in other parts of the province, crude antimony is obtained from high-grade ores by liquation. This process is carried out in furnaces, each of which holds two clay crucibles, the charge for each crucible being 50 lb. of ore. The crucibles are inclined and perforated at the bottom; they are fired for two hours, the liquated sulphide collecting in a cavity at the back of the furnace, from where it is ladled into iron molds and allowed to solidify. The pasty liquation residue is dumped into loose iron frames formed of two L-shaped pieces, in which it cakes together on cooling.

The Chinese estimate the value of a parcel of ore by putting a 100-lb. sample through the actual process, weighing the ingots obtained and expressing the yield in per cent. For instance, a 70% ore is one yielding 70% of its weight of crude, disregarding the antimony lost in the residues.

In assaying such ores I found that a yield of 70% of crude corresponds to an actual Sb content of 58%. The residue left from the liquation of the crude carried 26% antimony.

High-grade ores from Hu-nan usually run about 58%. Arsenic seldom exceeds 0.1%, lead, copper and zinc 0.05%, iron 0.5%. The ores are thus remarkably pure. In the assay of crude antimony obtained from these ores, I repeatedly noticed the percentage of antimony to exceed slightly 71.43%, which is demanded by the formula, Sb_2S_3, and this in spite of the fact that small quantities of impurities are always present, which should lower the antimony content.

If antimony is present in excess of the theoretical amount, the sulphur must necessarily be below it or in other words, the antimony is not all combined with sulphur.

In order to find out whether or not this was the case, I analyzed two samples of crude and obtained the following results:

	Crude		
	Sample I. Per cent.	Sample II. Per cent.	Regulus Per cent.
Antimony	71.60	71.70	98.20
Arsenic	0.069	0.048	0.148
Iron	0.821	0.14	0.146
Copper	0.015	not determined	0.025
Lead	0.011	not determined	0.006
Zinc	0.071	0.02	0.025
Insoluble	0.408	0.24	0.076
Sulphur	21.60	24.92	0.370
Total	94.595	97.068	98.996

The deficiencies in the results of these complete analyses may be caused by the presence of oxygen.

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Chino Copper Co.

The report of the Chino Copper Co. for the first quarter of 1913 shows a production of 12,021,872 lb. of copper, of which 3,400,274 lb. was produced in January, 4,018,789 lb. in February, and 4,602,809 lb. in March. During the quarter 429,750 dry tons of ore were milled, of which 47% came from the R-T-W orebody, and 53% from the Hearst orebody. The average copper content was 1.9094%. The ratio of concentration was 12.05:1; 35,664 tons of concentrates averaging 16.85% copper being produced. The average extraction was 73.25%. Only four of the five sections of the mill were in operation. On the day shift, 17 shovels were operated and six on the night shift, five being at work on the Hearst side, and two on the R-T-W orebody. The shovels handled a total of 803,578 cu.yd. of material in place, of which 568,177 cu.yd. were overburden.

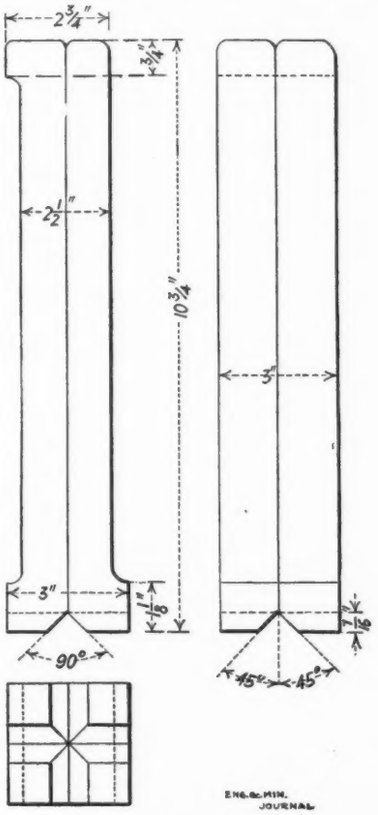
The cost per pound of net copper produced by milling operations for the quarter after allowing for smelting deduction and without making credits for miscellaneous revenues, was 8.24c. This could be reduced ¼c. by crediting miscellaneous income. All operations, administration, general charges, and cost of remodeling sections 2 and 3 of the mill, as well as a charge of 30c. per ton of ore treated, for the extinguishment of development and stripping charges, are included in this cost per pound. A decrease of ¼c. per lb. as compared with the last quarter of 1912, was made in spite of bad weather conditions in January, and the large amount of iron in the ore. The cost in March had been reduced to 7.42c. per pound.

The milling profit for the quarter was $778,804, to which must be added $29,019 for miscellaneous income, giving total net profits of $807,823, these earnings being calculated on an average price of 15.06c. per lb. of copper. At the close of the quarter, unsold copper to the extent of 5,500,000 lb. was carried at 12½c., and the balance of the unsold copper at 15c., giving an average price of 14.116c. per lb. on 16,454,389 lb., equivalent to a total inventory value of $2,322,698. The cash on hand at the close of the quarter was $329,976, no money being borrowed.

DETAILS OF PRACTICAL MINING

Four-Piece Dolly for Machine Sharpeners

The Champion Copper Co., at Painesdale, Mich., uses in the drill-sharpening machine a dolly which is made in four pieces. The advantage of this lies in the fact that the inclined faces can be dressed with comparative ease by grinding them on a wheel, whereas with a solid dolly or with a two-piece type, the grooves must be machined out, which necessitated drawing the temper and retempering. The shape and size of the dolly pieces are shown in the illustration. Shoulders are omitted on the bottom



FOUR-PIECE DOLLY

pieces in order that the dolly may be taken out of the machine more easily. It is held in its horizontal position in the machine between two horns rising from the bedplate, to which a cap is bolted. The size of the opening is regulated by shims. The use of this dolly, because of the ease of dressing it, results in more care being devoted to its condition and consequently in sharper drill bits.

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Rescueing in Shaft Sinking is being practiced at the Foster-Tough mine in the Porcupine district. About 14 in. of the rich ore is left on the hanging of the incline shaft until the mucking is completed after each round, when it is taken down and sacked for shipment.

Quick and Cheap Shallow Prospecting

BY E. J. WOLF*

A rapid and cheap method of prospecting by means of shafts and drifts within 50 or 60 ft. below the surface, known as the well-hole and "monkey-drift" method, is practiced in the Blue Ridge iron and manganese district of Virginia. The round well-hole can be carried to a considerable depth in clay ground without timbering, and one 30 in. in diameter can be driven rapidly in either clay or hard rock.

The necessary tools are: (1) An ordinary shovel from which the handle has been removed, leaving only enough as a dowel on which to fasten an iron deed, the entire length of the shovel not being over 20 to 24 in.; (2) a pick about 3½ lb. in weight, equipped with an 18-in. handle and with one point removed and the other given a chisel edge; (3) a windlass and bucket of 50 to 75 lb. capacity, with a safety hook; (4) if hard rock is struck, a set of drills with short-handled 4- and 8-lb. hammers.

With the pick and shovel in average clay ground, a workman can advance eight to 10 ft. in 10 hr. He can throw out by hand to a depth of about nine feet. It then becomes necessary to have an extra man and to use a windlass. The short-handled tools enable the laborer to work in a small space and thus cut down the amount of material removed. In hard rock by drilling holes from the center toward the sides, the rock will be so broken as to maintain the circular form of the shaft. The loading should be only heavy enough to break the ground well without throwing it. The smoke can be easily cleared out of the hole with a wet brush of pine limbs or by a blacksmith's blower and a pipe to the bottom of the hole.

Lateral exploration from such a shaft can be accomplished by so-called "monkey drifts." These should be about 2½ ft. wide and about 3½ ft. high. They can be run at any angle from the shaft, but should pitch slightly toward it in order to drain. Bailing the shaft is an easy matter. Drifting is rapid, two men being able to make four to eight feet per day. When in some distance, a third man can be added with advantage, and a blower becomes necessary to furnish air to the men in the drifts.

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Concrete Not Waterproofed by Western Petroleums

The U. S. Office of Public Roads announced about two years ago that experiments undertaken with concrete mixed with petroleum residues had shown that a waterproof product could be thus obtained without diminishing the strength or other good qualities of the concrete to any appreciable extent. In the *Proceedings* of the American Society of Civil Engineers for March, 1913,

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Arthur Taylor and Thomas Sanborn announced that as the result of experimenting with oil-mixed concrete using Western oils with an asphaltum base, entirely discordant results were obtained. The results in general were as follows: That the oil-mixed concrete was more permeable than that not containing oil, and that the tensile and compressive strengths of the oil-mixed mortars were considerably decreased. These unfavorable results were particularly the case when the more viscous oils were used. It is evident that in any attempt to waterproof concrete by petroleum admixture, the nature and characteristics of the petroleum must be carefully investigated.

Betts Stuck-Drill Extractor

A recent invention by Benjamin F. Betts, of Mazuma, Nev. (U. S. pat. 1,042,873), is an attempt to supply the long-felt want for a device to pull stuck drill-bits out of their holes. The general layout of the apparatus can be seen in Fig. 1. The piston machine is shown in diagrammatic form, rigged to extract the stuck drill from which it has just been detached. By forcing down one

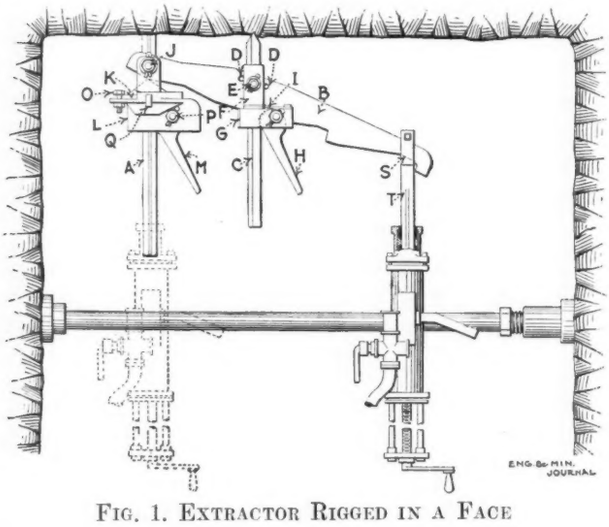


FIG. 1. EXTRACTOR RIGGED IN A FACE

end of the lever *B*, which pivots on the bar *C*, the other end is forced downward and carries with it the stuck bit.

The lever *B* contains several holes *D*, which may serve as pivoting centers, thus giving variable leverages. A pin *E* passes through one of these holes and similar holes in the yoke *F*. This yoke *F* has an offset portion *G*, shown in section in Fig. 2, which can be clamped to the sharpened bar *C*, by the cam lever *H*, which is toothed to grip the bar *C*, the teeth held by a leaf spring *I*.

The gripping end of *B* is forked, the forks carrying two pivot lugs *J*, which serve as a connection to the clamping device. This device consists of two parts, the lower part *K* being connected to the pivot lug *J* and the upper part *L* carrying a cam lever *M* for clamping to the steel to be extracted. These two parts can rotate on each other or can be locked, as seen in Fig. 2. The portion *K* has a flange *N*, which travels in a groove in *L*, and is held against slipping out by means of the broad-headed bolt *O*. The cam lever *M* pivots at *P* and has teeth on the inner side to grip the steel as shown. The parts *K* and *L* are locked against rotation by the key *Q*, which enters the slots *R* in the two portions. The object of providing for rotation is to allow the steel to be turned with a wrench, to assist in loosening it, without disengaging the clamp.

The other end of the lever *B* is hooked as shown and carries a yoke *S*, which has a shank *T* suitably formed for insertion in the chuck of the machine. As illustrated, the device is working in connection with a piston drill; there would seem to be nothing in its construction to prevent it operating similarly with a hammer drill.

Concrete Drop Shaft

The Adams shaft, on the Cuyuna range, near Deerwood, Minn., was sunk through quicksand to a depth of 130 ft. by a combination of open-dredging and pneumatic-caisson processes (*Eng. Rec.*, Apr. 5, 1913). The presence of water-bearing strata rendered these methods necessary. The process consisted of forcing a cutting edge through the formation by the weight of the concrete lining erected upon it and removing the material at first, from within and below the edge, by means of a bucket operated on a derrick boom and later by excavation through a caisson. The dimensions of the shaft, which was rectangular, were 10 ft. 10 in. by 14 ft. 10 in.; the concrete shell, circular on the outside, was 27 ft. in diameter over all.

The cutting edge was built of an angle; one vertical leg, reinforced with a vertical plate, formed the outer side and had an inclined inner wallplate riveted to it, so as to

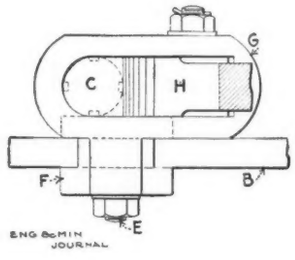


FIG. 2. SECTION OF FULCRUM DEVICE

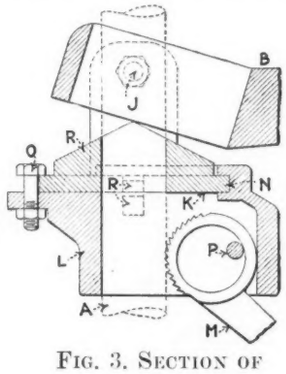


FIG. 3. SECTION OF BIT CLAMP

give a V-section. Transverse bracing connected these inner and outer plates and reinforcement rods projected, into the concrete. The exterior form of the concrete was made of ¼-in. steel plates 5 ft. wide, with exterior vertical and horizontal flange angles to form the necessary connections between sections and between successive courses. The inside form was made of vertical 2-in. square-edged timber nailed to horizontal pieces. The dimensions of the inside forms were increased from the bottom up to correspond with the diminishing thickness of the shell, which varied on its thickest side from about 6 ft. at the bottom to 5 ft. at the top, the reduction being effected by 6-in. horizontal offsets in the inner face. Vertical and horizontal twisted reinforcing bars were used.

The concrete shell was built to a height of 20 ft. on the surface, the cutting edge being set in a 3- or 4-ft. excavation, which reached to the ground-water level. When the concrete was set, excavation was begun and the shell allowed to sink, the forms being moved upward and concrete added to keep pace with the setting. The water-bearing formation was excavated with a 1-yd. clam-shell bucket on an ordinary derrick boom with a double-drum hoisting engine. Care was necessary to maintain the

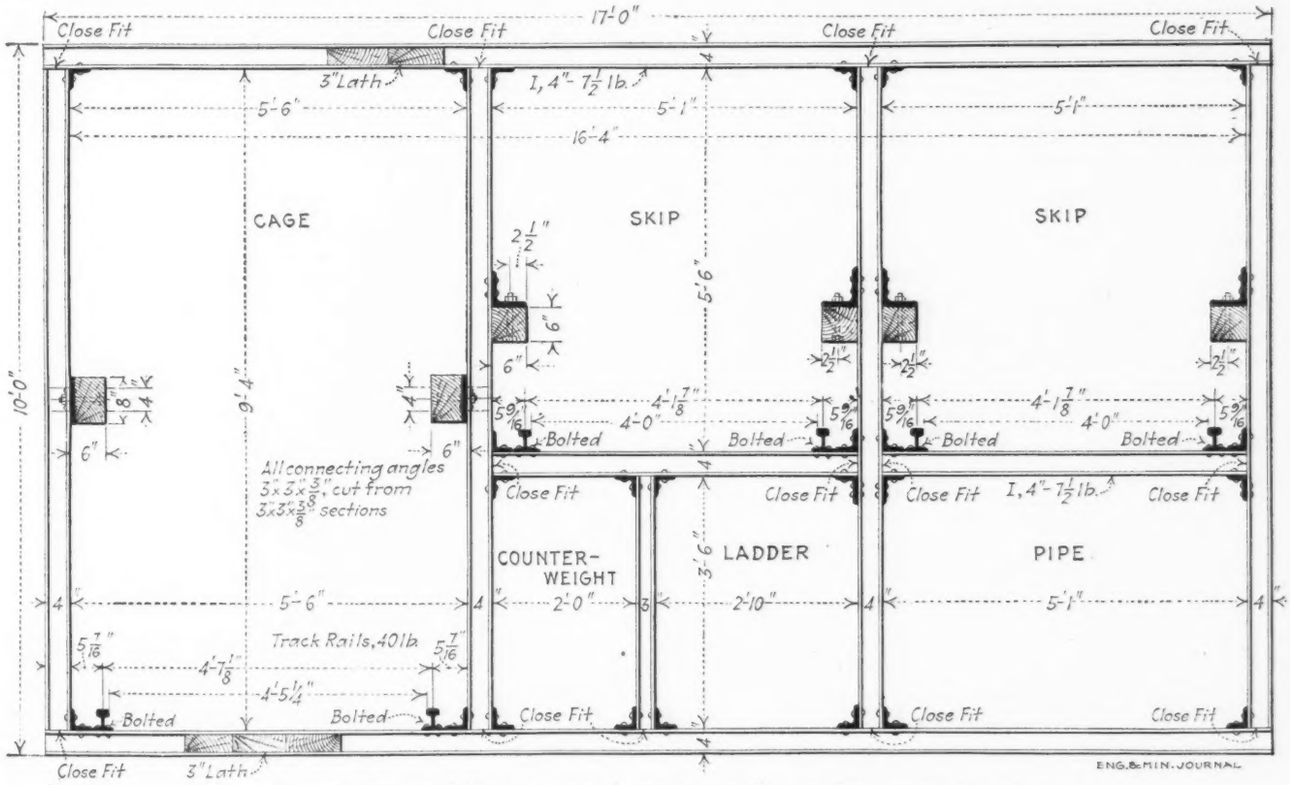
shell in a vertical position by dredging more on the high side if it began to tip. In order to obtain as much weight as possible, the concrete height above the ground was increased to 30 ft., the limit of reach for the boom.

At 60 ft. a stratum of boulders was encountered which the bucket could not handle and recourse was had to pneumatic methods. An air-tight deck of double-crossed tiers of heavy timber was built to form a horizontal diaphragm in the shell, 60 ft. above the cutting head, the timbers being anchored in the concrete. On this was set a 4-ft. steel shaft surmounted by a Moran airlock. Air was obtained from a 3000-cu.ft. compressor plant, 30 lb. per sq.in. being maintained in the caisson. Around the caisson 300 tons of pig iron and 250 tons of sand were piled to give additional sinking weight. Sinking continued in this manner until a point 18 ft. from the rock was reached when the enormous friction developed made it impossible to force the lining further. A rectangular offset in the V-shaped cutting edge had been left for concrete. Excavation was continued far enough below the surface of the rock to provide a concrete lining connecting with the upper shell, producing a water-tight joint.

The work with the curbing was slow, expensive and dangerous on acount of the high pressure used. An average force of 50 "sand hogs" was used, and, although the pressure reached a maximum of 52 lb., only one fatal case of the bends occurred. Eight gangs were used, each working two 40-min. shifts per 24 hr. The shell contained 2000 cu.yd. of 1:3:5 concrete made with Chicago AA portland cement, mixed in a Marsh machine. The work was done by the Foundation Co., of New York, Frederick W. Addage, of Chicago, Western manager.

Steel Set for Inclined Shaft

The accompanying drawing shows a detailed plan of a steel shaft-set used at No. 4 shaft of the Montreal mine, described by G. E. Des Rochers, in *Mine and Quarry*, April, 1913. The set is for an inclined 10x17-ft. shaft, outside measurement, and has compartments of the dimensions shown.



STEEL SET OF I-BEAMS AND ANGLES FOR LARGE INCLINED SHAFT

Simple Method of Cutting Rails

Cutting rails with saws or by chiseling and dropping is slow and expensive. A superior method is recommended by George E. Tonney in *Engineering Record*, May 24, 1913. For cutting a rail in place, remove the spikes from the end to be cut off; on the outside, chisel a line about $\frac{1}{16}$ in. deep, from the edge of the base to the top of the head; bend the rail over as far as possible by the use of crowbars and at the same time on the inner side of the web near the base on the line of the desired cut place a chisel and give it a hard blow with a heavy

sledge, while the pressure is exerted on the end of the rail. The rail will almost always snap apart with a cleancut break. If an extremely neat break is desired, saw a line about $\frac{1}{16}$ in. deep across the head. A length as short as 12 in. can be removed, providing another rail is attached to make it possible to exert the necessary pressure.

Shallow Holes and Crossbars

Discussing the paper on the Rawley tunnel, presented by Messrs. Simonds and Burns, before the New York meeting of the A. I. M. E., W. L. Saunders noted the difference between American and European tunnel-driving practice (*Compressed Air Mag.*, April, 1913), as follows:

The dimensions of the Rawley tunnel are seven feet high by eight feet wide with a length a little over 6000 ft., a typical mining tunnel. The best monthly progress, with 8- to 12-ft. rounds, is 414 ft., and the best monthly progress for the shallow rounds of 4½ to 5½ ft. amounted to 555 ft. I want to call particular attention to the statement that when they changed from a double shift to a triple shift, putting in shallow holes, they got better progress. The shallow-hole idea is the European idea, it is the Alpine tunnel idea. These recent Alpine tunnels have all been driven on the shallow-hole plan, in other words, they put in a hole about a meter or a little more in depth, and of rather large diameter, as compared with the American system, which is a hole as long as you can reasonably get it; and that means that by the time it is in to the bottom, say 10, 12 or 14 ft., it is just a little larger than the diameter of the steel, the result being that you are putting the explosive at the bottom in a section of hole of small diameter, which is the very reverse of what is wanted to produce the most effective results. It is much better—and this is a point I have emphasized before the Institute in papers in the past years—to put in a large number of shallow holes of large diameter and use a great deal of powder than to put in a small number of deep holes and try to save powder and try to be particular about the exact direction that the hole must take. The European system simply peppers the head with holes, and they get better results by doing it.

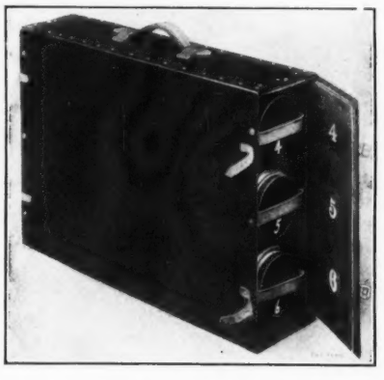
This tunnel was driven with a horizontal bar across the tunnel, a thoroughly modern system, the same, by the way, as was used at the Laramie tunnel. In the American system of tunnel-driving vertical columns with arms on them are usually employed. The European system employs horizontal bars mounted on carriages. The system described in this paper is neither one nor the other; but a modification of the Alpine system of tunnel driving, doing away with the carriage. The piston drill creates a great deal of shock on its mounting, necessitating a heavy bar or column. The machine itself is heavy, and must be used with either a carriage or a vertical column with arms.

In this tunnel they used a hammer drill, which is lighter in weight and does not give the jarring, hence making it possible to use a light bar which a few men can handle. This light bar, after the blast, is jacked in place close to the roof. By the time the muck is removed, the drillers are about ready to let the bar down to put in the lower row of holes. With this system they have made a progress, I believe, of 26 ft. per day. That, of course, is not the record. The Alpine system has made about 30 ft. per day, and in the Laramie tunnel they have made something like 24 ft. a day. Comparing progress of this character, however, we must always take the rock into consideration, and the length of the tunnel. The Alpine tunnels are longer tunnels, and they were able, by adopting a certain system and carrying it out for a long period of time, to get the efficiency of the workers extremely high.

Nonfreezing Powder Carrier

For a small, isolated job of surface blasting around a mine in cold weather, the carrying case shown in the accompanying drawing may be useful. The case, according to *Engineering News*, Jan. 23, 1913, is made on the principle of the "Thermos" bottle and was devised by W. O. Taylor, of Columbus, Ohio.

Dynamite properly placed in the bottles or tubes will remain unfrozen for 12 hr., it is said, even when exposed to a temperature of 12° to 15° below zero. The dynamite must be thoroughly thawed before charging and the tubes warmed by exposure to a temperature of 65° for five minutes with the corks drawn. The device



TAYLOR NONFREEZING DYNAMITE CARRIER

is being introduced by the Dynamite Temperature Carrier Co., 200 Fifth Ave., New York. The largest size manufactured at present is 7x19x26½ in. and weighs 30 lb. empty. It contains six tubes, three in each end, which will hold seven 1¼x8-in. sticks each.

Steam-Shovel Types

The typical Mesabi steam shovel is of the Marion or Bucyrus type, using a multiple-chain hoist on the dipper. The Robinson shovel which has been introduced in recent years contains original features of design. The hoisting machinery, says Charles E. van Barneveld in "Iron Mining in Minnesota," is mounted on the boom, eliminating guide sheaves; the bucket is pulled by a double-wire rope over a single large sheave; the bail and dipper-sheave are discarded and the ropes attached directly to the dipper back. By these changes the net lift is increased for a given length of boom; the digging angle and consequently the useful resultant of the pull of the hoisting rope are increased; friction is greatly decreased. The makers claim a final increase of practically 100% in digging power.

DETAILS OF METALLURGICAL PRACTICE

Safety Rules—Miscellaneous Instructions*

(1) All guards and safety devices, and wherever practicable, moving parts of dangerous machinery shall be painted a bright red.

(2) All places from which employees or others are prohibited must be marked with suitable danger signals or signs indicating that no thoroughfare is to be established over such forbidden ground.

(3) Report promptly to your foreman any defective condition affecting the safety of any employee.

(4) When in doubt as to the meaning of a rule or of guarding dangerous situation, consult with the safety inspector.

(5) Vigilance and watchfulness promote safety. To avoid danger, adopt the safe course. Do not trust to the care exercised by another, when your own safety is involved.

(6) Any person coming to work under the influence of liquor will be discharged.

(7) If you are injured, no matter how little, tell your foreman about it at once, and go to the doctor. A slight injury may cause blood poisoning.

(8) If you find anyone sick or injured on the property of the company, whether an employee or not, take him to the hospital.

(9) Keep tables, walks, etc., clear of blocks, wedges, and other material, as someone may stumble over them.

(10) Do not take short cuts across dangerous places. Do not go through the boiler house or mills at any time, unless your duties take you there. Go by the road.

(11) Sufficient artificial illumination shall be provided at all times and places wherever necessary.

(12) Windows shall be kept cleaned.

(13) Wherever practicable walls shall be whitewashed or painted white.

(14) Be watchful of loads carried by cranes or suspended in the air, and keep out from under them.

*From Inland Steel Co.'s book of rules.

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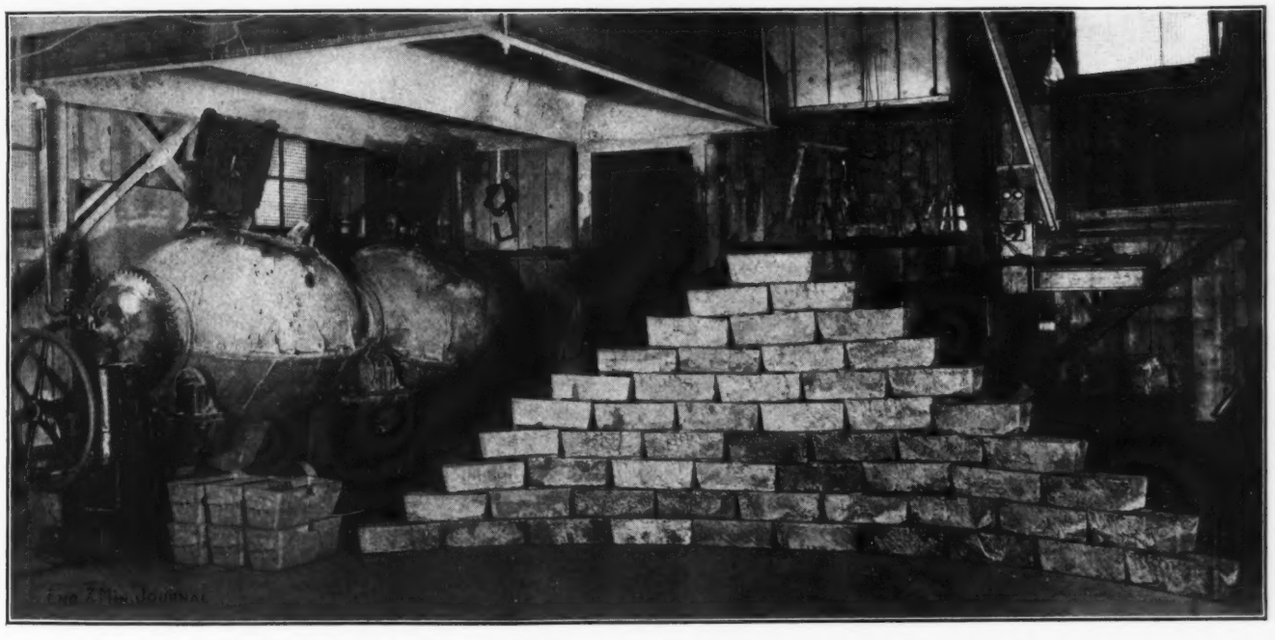
Precipitate Melting at the New Belmont Mill, Tonopah

By A. H. Jones*

At the refinery of the new Belmont mill at Tonopah, there are two double-chamber No. 3 Rockwell furnaces which have satisfactorily melted 3,000,000 fine oz. of bullion, gold and silver, during the past 10 months. The



Rockwell Furnaces and Bullion Bars at the Tonopah-Belmont Mill

cost of lining one of these furnaces is $231.45, divided into 25 sacks carborundum and kaolin, 2550 lb. at $0.04. $210; ½ bbl. water glass, $11.45, and $10 for labor. One lining has melted 500,000 oz., making the lining cost $0.462 per 1000 oz. The crucible cost with Faber du Faur furnaces, on No. 3 Dixon retorts, was $1 per 1000 oz. of bullion produced.

One melt of 105,676 oz. was melted in 36 hr. from the time of lighting the fires in the two furnaces, with the following cost: 1139 gal. fuel oil at $0.0383 per gal., $43.62; labor, $40.95, and power for blower, $6, making a total of $90.57, or $0.0009 per ounce.

*Superintendent, Belmont Milling Co., Tonopah, Nev.

The labor used included a head melter, two shifts at $175 per month, $11.70; melters, 2½ shifts, at $4.50 per shift, $11.25; helpers, 4½ shifts at $4 per shift, $18; making a total of $40.95. The precipitate runs from 60 to 80% fine, and is melted without any acid or other treatment, the resulting bullion being over 900 fine in gold and silver.

Briquetting is done on a Grath Little Giant machine, furnished by Illinois Supply & Construction Co., of St. Louis, Mo. Two special disk-shaped dies were made, in place of the briquette die, 3½ in. in diameter, making briquettes from 2½ to 3 in. deep and, depending on pressure and feed, weighing about 2 lb. each. Running continuously, the machine will turn out two briquettes eight times per minute—or 1900 lb. per hr., but in practice the speed is about 1000 lb. dry product briquetted, together with required flux, per hr. The machine weighs 9230 lb. and cost $997.50 plus $410.74 freight, or a total of $1408.24 delivered at Tonopah.

ANALYSIS OF FLUE DUST

Insoluble	6.0%
Gold and silver	8.6
Si	1.4
Cu	0.5
Pb	Tr.
Fe_2O_3	2.4
CdO	8.2
ZnO	15.0
SO_3	14.0
Carbon and Oxygen	Difference

There are 80 ft. of 30-in. flue in the refinery, running from hoods 60 ft. outside of the house, raising at about 20°, with 20 ft. of stack. In cleaning the flue, about the same results are obtained each time. With 1,749,135.51 oz. melted, worth $1,439,225, there was recovered from the flue by three cleanings, 124 lb. dust worth $1 per lb. or 0.0086% of the bullion recovered. The analysis of the dust is given in the accompanying table.

Joplin Intermittent Settling Tank

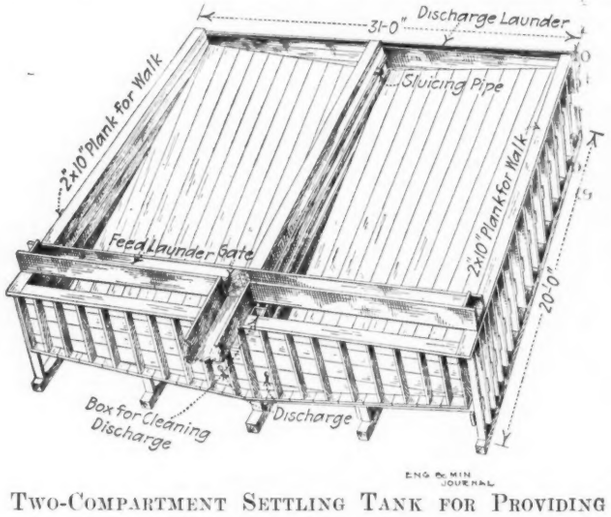
By Claude T. Rice

The flat topography of the Joplin district makes elevating necessary if cone continuous settlers are used for the table feed. It is more common practice, therefore, to use a flat settling box which works intermittently. The construction of these is characterized by a good deal of ingenuity. They are usually built in pairs with their bottoms sloping diagonally to the discharge from the opposite corner. The operations are consequently so nearly self-controlling as to necessitate little attention. The illustration gives the essential features of the tank. Proper dimensions would be about 15x20 ft. for each half, as shown. The grade should be about 3 in 20. This determines the length, since only a certain amount of fall can be allotted to the box in the layout of the plant. The width is in turn determined by the length, as the compartment should be about square to get the best sluicing effect.

The tank sides and bottom are built double of 1-in. planks and have strips of ball wicking inserted which catch the silt and thus form a tight box. No trouble from leakage results. The frame of the tank is made of 2x6-in. joists and studding. The central partition is built double to resist pressure when one tank is full and the other empty. Each wall of this is of 2-in. planks with battens over the cracks. This partition, as well as the top of the studding of the outside walls, is covered with a 2x10-in. plank to serve as a walk. Usually two tie-rods run across in each direction in each half to take up side pressure.

The feed is admitted at the deeper end of the tank over the lip of a launder. By means of a gate the feed is thrown to either compartment. In the best construction, this launder is set 10 in. or a foot toward the center of the tank, sufficient to admit a small vertical bottomless box over the discharge spigot extending almost down to it so that if it becomes clogged, it can be punched out easily. The clarified water discharges at the shallow end of the tank into a launder which conveys it to the settling pond. The side here is made about four inches lower than the other sides to prevent an overflow on all sides if the overflow launder should clog.

Water under pressure can be used for sluicing the settled material, but it is easier to maintain a constant consistency and is better practice to sluice with clarified water from the other half of the tank. A 1-in. pipe through the central partition connects the two compartments and by attaching a hose to this, the clear water from the tank which is being filled, can be conducted to the far corner of the tank which is to be sluiced. It is



Two-Compartment Settling Tank for Providing Uniform Table Feed

guided along the periphery of the tank from this point by cutting a trench six inches deep around the outer side to a point over the discharge spigot. The current hugs the box until it reaches the bottom of the sand and then begins to eat toward the center. The slope of the bottom is such as to keep the water in contact with the sand to the greatest possible extent, and thus make it carry its full burden of material and furnish a product of constant thickness. A double tank of approximately the dimensions given is capable of handling about 250 tons in 10 hr. The dimensions are those used by J. G. Marcum in designing Joplin mills.

The Steam Regenerator is a device usually used in conjunction with low-pressure turbines. Its function, like that of a flywheel or a storage battery, is equalization of load through storage of power. Since the consumption of power by the turbine is not always equal to the power furnished by the exhaust of the reciprocating engines, the regenerator is installed between the two machines to store heat, when an over-supply is furnished, and to give up heat when the consumption is greater than the immediate supply. In the regenerators first built this storage was performed by cast iron; the later types use water as the storing medium. Thus during periods of excess supply the water absorbs heat from the exhausted steam, and when consumption again overtakes supply or passes it, the water yields up its heat.

THE COST OF DOING THINGS

Wasp No. 2 Mining Co.

The Wasp No. 2 Mining Co. is situated in the Black Hills district, South Dakota, and has paid $401,966 in dividends to Apr. 15, 1913. The orebody is flat and is covered by only a few feet of overburden, which is removed by steam shovel. The gold occurs in quartzite, which is about 20 ft. in thickness. After stripping, holes are drilled to the bottom of the quartzite, and after sloughing with dynamite are blasted with black powder. The ore is handled by cars to a skipway, which leads to the mill bins. According to the annual report for 1912, 158,840 tons of ore were mined, 40 tons of which were shipped and the remainder treated at the mill. The mill heads assayed $2.34 in gold and 0.64 oz. silver per ton. The mill recovery was $1.95 per ton, including silver. The mill extraction was 75.90% of the gold and 30.28% of silver contents based upon the actual returns. The total operating cost was $1.2337 per ton, made up of 75.71c. for mining, 62.65c. for milling and 4.01c. for general expenses. Expenditures for construction and equipment amounted to 6.2c. per ton, indicating a total expenditure of about $1.30 per ton.

80% supplies and 20% labor for indirect charges. Labor made up 56.6% of the development charge, 55.8% of stoping, 61.5% of timber, 87% of tramming, 70.5% of hoisting and 67.5% of ore sorting and concentration. Some of the principal items of cost were: Development, $1.67 per ton of ore; stoping, $1.33; timbering, 37.6c.; tramming, 28c.; hoisting, $1.12c.; ore sorting and concentration 1.32c.; mine office, 17.8c.; New York office and salaries, $1.07; superintendence, 31.4c.; marketing, $1.02; and plant and equipment, 46.5c. per ton of ore.

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Comparative Costs of Rand Hoisting Systems

The flat dip of the Witwatersrand reefs, as is well known, makes the problem of hoisting a peculiar one. For the mines not situated on the outcrop, three possible solutions exist: a shaft entirely vertical with long crosscuts to the orebody; a turned-vertical shaft, that is, a shaft vertical to a point near the intersection with the reef and inclined from that point; and a combination of vertical and inclined shaft with separate hoists operating on each portion and involving a transfer of ore underground. The turned vertical shaft is pretty well discredited now. The accompanying table, from an article by R. C. Warriner (Journ. So. Afr. Inst. of Eng., April, 1913), describing the Crown Mines, Ltd., furnishes an illuminating comparison of the costs of hoisting through a vertical shaft and a two-stage system.

POWER COST HOISTING IN SINGLE-STAGE AND DOUBLE-STAGE SYSTEMS

	Month	Total Number	Trips Made: Percentage of Ore	Trips Made: Percentage of Men and Material	Trips Made: Percentage of Water	Tons Hoisted	Total Power Units Consumed	Power Units per Ton	Cost per Ton, Cents
No. 5 Shaft	Sept.	13,949	91.6	5.6	2.9	88,044	405,758	4.60	4.8
	Oct.	16,416	91.0	8.0	1.0	105,836	428,201	4.05	4.2
	Nov.	17,511	84.4	9.0	6.6	101,896	456,216	4.48	4.8
	Dec.	18,923	81.5	8.9	9.6	109,430	478,411	4.38	4.6
	Jan.	23,194	85.7	10.6	3.7	135,940	554,973	4.08	4.2
No. 7 Shaft Vertical Portion	Nov.	23,717	73.0	27.0	....	68,638	196,767	2.87	3.01
	Dec.	24,269	75.0	25.0	....	71,082	211,910	2.98	3.14
	Jan.	26,559	72.5	27.5	....	74,224	223,800	3.01	3.16
No. 7 Shaft Inclined Portion	Nov.	14,325	57.0	43.0	....	30,030	84,639	2.81	2.94
	Dec.	14,927	55.0	45.0	....	29,289	87,038	2.97	3.12
	Jan.	16,208	56.0	44.0	....	28,912	98,128	3.39	3.56

No. 5 is a vertical seven-compartment shaft, 3434 ft. deep. The hoisting equipment consists at present of two double cono-cylindrical drum electric hoists, each driven by two 1420-hp., 500-volt motors on the Ward-Leonard system. The skips hold eight tons each, weigh 8700 lb. empty and are hoisted at a rate of 46 per hr. from a depth of 2257 ft., near the 13 level of the mine, a main haulage level. The man cages are four-deck, carry 80 men each and handle the shift of 3200 men in 1¾ hr. One engine runs continuously on rock. The other handles the men in shifting. The bailing represents the extraction of accumulated slimes from the settling sump before pumps were installed. The actual hoisting point is the ore pocket 200 ft. below the 13 level.

No. 7 shaft is a two-stage arrangement. The vertical portion is served by two double-drum hoists converted from steam-drive to electric by coupling direct to two

The details of mining costs were as follows: Labor, 27.46c. per ton of ore; stripping, 14.05c.; supplies, 4.32c.; coal, 0.85c.; general expense, 0.62c.; explosives, 4.03c.; stable, 1.38c.; assay office, 0.49c.; superintendence, 1.58c.; power, 1.81c.; and tools, 0.12c. Milling expense consisted of labor, 20.57c.; supplies, 6.0c.; repairs, 9.10c.; coal, 0.85c.; cyanide, 8.06c.; general expense, 0.62c.; stable, 0.90c.; assay office, 0.69c.; superintendence, 1.58c.; lime, 1.36c.; cleanup, 0.87c.; zinc, 3.64c.; power, 8.28c.; and tools, 0.13c. per ton.

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Wettlaufer Lorrain Silver Mines

The 1912 annual report of the Wettlaufer Lorrain Silver Mines, Ltd., Cobalt district, Canada, states that 17,068 tons of ore were produced at a total cost of $197,824 or $11.61 per ton, made up as follows: Production and development, $9.15; shipment, treatment and other charges, $1.02; administration and general expenses, $1.07, and option expense 37c. per ton. The silver production was 815,998 oz. and total cost including option expense, 24.2c. per oz. The total cost consisted of 55.5% supplies and 44.5% labor, while direct charges were made up of 35.8% supplies and 64.2% labor, against

three-phase, 2000-volt, 50-cycle, 930-hp. motors. The four skips hold four tons each, weigh 5130 lb. empty and are hoisted at the rate of 60 per hr. The vertical portion of the shaft is 1085 ft. The man cages are three-deck, holding 36 men. The shift of 1000 men is raised in 1¼ hr. The inclined portion of the shaft is equipped with two double-drum electric hoists, each geared to one three-phase, 50-cycle, 2000-volt, 655-hp. motor. The four skips weigh each five tons. The length of the incline is 2004 ft., the dip 33°. The ore handled through this shaft comes on an average from the seventh level of the mine.

The figures are striking, as, although the ore of the No. 5 shaft comes from a greater depth, the average cost of power per ton handled is about 4.56c., as against 6.3c. for that handled on the two-stage plan. From this, it would appear that hoisting in two stages is more expensive by about 50% in power cost alone. It should be noted that the double-stage hoisting is done on a smaller scale, however, which might be considered to offset the shallower depth. Additional costs, such as more engine drivers, supplies and shop and maintenance charges also favor the single-stage system. A full comparison of the methods would involve points not gone into here.

Allouez Mining Co.

The following review of the Allouez Mining Co., Calumet, Mich., was taken from statements given in its annual reports:

Year	Tons Ore Crushed	Lb. Copper per Ton	Lb. Copper Produced	Total Cost per Lb. Copper Cents	Net Cost per Lb. Copper, Crediting Other Receipts
1906	178,292	19.5	3,486,900	13.7	13.7c
1907	214,720	9.85	2,134,116	40.8	40.8
1908	220,905	13.80	3,047,051	16.9	16.9
1909	253,049	15.93	4,031,532	13.35	13.3
1910	247,119	18.84	4,655,702	11.6	11.1
1911	288,610	16.56	4,780,494	13.3	13.1
1912	333,618	16.56	5,525,455	13.52	13.4

The cost of mining, transportation, stamping and taxes per ton of rock has been $1.806, $1.769, $1.668, $1.613 for the years 1909 to 1912 in the order named. The rock discarded by sorting at the rock houses amounted to 1.868% in 1912, compared with 2.049% in 1911 and 2.33% in 1910. The costs for 1912 consisted of mining, 9.74c. per ton of copper; construction, 1.60c.; smelting, selling expense, etc., 1.87c.; and interest, 0.31c. per lb. of copper. The development work included in 1912 amounted to 8517 ft., which is an increase of 1288 ft. over 1911 and 1758 ft. over 1910.

Cost of Artificial Ice

For those mining companies in tropical or semi-tropical climates that are figuring on artificial-ice plants, the following data may be of interest. They are based on a 6-ton plant, operating in Georgia in connection with a central-station power plant. The output for the summer was 1500 tons (*Electrical World*, Apr. 26, 1913).

Steam-compression apparatus is used for handling the ammonia. The total investment, including the buildings and refrigeration plant, is given as about $10,000. A statement of the yearly operating expense is as shown in the accompanying table:

Fuel	$750
Labor, including office	400
Miscellaneous	50
Delivery	280
Total	$1480

Bunker Hill & Sullivan

According to the report of the manager, the Bunker Hill & Sullivan Mining & Concentrating Co., Kellogg, Idaho, during the period June 1, 1911, to Dec. 31, 1912, stoped 699,160 tons of concentrating ore at a cost of $1.541 for the following items: Foreman, bosses, blacksmiths, machinists, nippers and supply men, 17.7c. per ton; timbermen and carpenters, 8.6c.; miners, 36.7c.; carmen, 5.2c.; shovelers, 36.6c.; power labor, 2.7c.; repair labor, 2.6c.; explosives, 7.5c.; illuminants, 2c.; lubricants, 0.3c.; iron and steel, 1.2c.; miscellaneous supplies, 3.5c.; timber and lagging, 21.5c.; power supplies, 4.5c.; wood, 3.4c.; and stable and stock, 0.1c. per ton of concentrating ore. The mine also produceed 3360 tons of crude shipping ore at a cost of $16.244 for extraction made up as follows: Foreman, bosses, blacksmiths, machinists, tool packers, etc., 5.5c. per ton; timbermen and carpenters, 2.6c.; miners, 16.4c.; carmen, 0.5c.; shovelers, 15.3c.; lessees, $15.652; power labor, 1.1c.; explosives, 5.2c.; repair labor, 1c.; illuminants, 0.8c.; lubricants, 0.2c.; iron and steel, 0.5c.; miscellaneous supplies, 1.3c.; timber and lagging, 5.8c.; power supplies, 1.7c.; and wood, 1.3c. per ton of shipping ore.

The electric railroad was in operation for the full period of 19 months, during which time it delivered to the concentrators 701,620 tons of ore, at a cost of $51,995, or an average cost of 7.4c. per ton hauled made up as follows: General labor, 0.3c. per ton; trammers, 2.3c.; power labor, 0.5c.; repair labor, 2.3c.; illuminants, 0.1c.; lubricants, 0.1c.; iron and steel, 0.2c.; miscellaneous supplies, 0.8c.; and power supplies, 0.8c. per ton hauled. During the period mentioned, the railroad was in operation 1160 shifts of 8 hr. each, of which 30 shifts were lost due to holidays, etc. The average work of the railroad therefore, was 605 tons per shift, or 621 tons per shift of actual operation. This work includes hauling of timbers and other supplies.

The concentrating plant treated 697,560 tons of ore at the rate of 1256 tons per 24-hr. shift, at a cost of 35.9c. per ton, as given herewith: General labor, 3.5c.; millmen, 12.1c.; laborers, 0.7c.; power labor, 0.4c.; crusher labor, 0.3c.; repair labor, 1.9c.; illuminants, 0.2c.; lubricants, 0.4c.; iron and steel, 0.1c.; miscellaneous supplies, 5.3c.; timber lagging, 0.6c.; roll shells, 0.4c.; trommel screens, 0.6c.; crusher supplies, 0.4c.; power supplies, 8.1c.; and wood, 0.9c. per ton treated. The tailing mill was in operation for a period of 161 days and treated 78,100 tons of tailing at a cost of 14.8c. per ton. A total of 99,968 tons of concentrate and crude ore were shipped at a cost of 23.8c. per ton for labor and supplies.

Development consisted of 11,050 ft. of drifts, crosscuts, raises and winzes. The average cost per foot was $7.15, of which the principal items were: Foreman, blacksmiths, etc., 31.2c.; miners, $2.50; shovelers, $1.65; explosives, 99c.; timber and lagging, 40c.; and power labor and supplies, 52.4c. per foot. A detailed statement of exploration shows that tunnel driving cost from $1.94 to $9.34 per ft. for labor and supplies, drifting, from $3.27 to $10.71; and raises from $1.20 to $5.23 per foot. Summary of all operations gives a cost of $2.25 per ton of ore mined, made up of: Stoping, $1.60 per ton, tramming 7.4c.; concentrating, 37.4c.; shipping, 3.4c.; superintendence and office, 7.3c.; and legal and contingent expenses 9.3c. per ton.

Sinking against Water on the Rand

SYNOPSIS—Describes process of sinking a seven-compartment shaft on the Rand against a water flow of about 1300 gal. per min. Sinking pumps were used, operating under a low head, and four bailing tanks which took their water from rings around the shaft sides.

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Two shafts, now being sunk at the Springs Mines, in the Transvaal, present some new features in sinking through water-bearing strata, so far as experience on the Rand is concerned. Each shaft is of seven compartments. Six of the compartments are 6 ft. 6 in. by 5 ft., inside timbers, and the seventh, or pump compartment, is 6 ft. 6 in. by 6 ft. The excavation measures approximately 42x9 ft., and the arrangement is as shown in Figs. 1 and 2.

The sinking conditions covered here may be divided into two periods: (1) The period from the date water was struck in the dolomite, of the Black Reef series, to the time the pump chamber was started in the Witwatersrand quartzites; (2) the period from the installation of the pump station to the time the permanent electric pumps were started. As the two shafts are equipped in the same manner, and the conditions vary merely as to the quantity of water dealt with per day, only the north shaft, in which the maximum amount of water is met with, need be referred to in detail.

Equipment for First Sinking Period

The equipment for the first period consisted of: A wooden headframe, 65 ft. high, erected over compartments Nos. 2, 3, 4, 5 and 6; two 16x30-in. double-drum geared hoists for compartments Nos. 2 and 3, and 5 and 6; four 600-gal. tanks with 24-ft. shoes for bailing below timbers; one single-drum winch for handling rock from the bottom through No. 4 compartment; two horizontal low-lift Worthington pumps, 10-in. suction, 8-in. delivery, 7½x10¼x10 inches.

The plan of the shaft, with the equipment provided for this initial period, was, therefore, as shown in Fig. 1. The Worthington pumps were carried on the bottom set of timbers in such a way that they could be lifted, lowered, or handled, as desired, entirely within their own compartments. They were further equipped with a patent pipe-joint on the suctions, whereby the suctions could be disconnected by merely raising a lever. The suctions were further connected by wire ropes to hand winches on the surface, in order that they could be raised when blasting was being carried on. The pumps were used solely for lifting the water from the shaft bottom and delivering it to a ring, whence it was bailed by the engines to the surface. As the pumps were overloaded all the time, the head was never allowed to exceed 30 ft.; and when this lift had been reached, a new ring was installed, the head reduced, and the bailing tanks lowered to the new level.

Water was struck at 460 ft. below the surface, and followed the shaft down along a fissure to a depth of 605 ft., at which point the Witwatersrand quartzite was entered. Altogether, six rings were put in at depths varying from 450 ft. to 619 ft., the deepest, which afterward delivered the water to the permanent pump sump, being below the dolomite. All these rings were connected by down pipes to run any water caught up by them to the lowest or bailing ring.

The construction of the rings was as follows: A wooden bottom, 4 in. thick, was fitted carefully from the outer edges of the plates to the rock walls of the shaft between the blocks. Planks 3x9 in., planed and blanketed, were placed on edge around the shaft flush with the inner sides of the plates, and the space between the planks and the rock walls was filled in with concrete to the top of the planks. Similar planks were then built up on edge to the height of the next plate above, thus forming a tank all around the shaft about 5 ft. deep. The sides of the tank were then fitted with two 8-in. sluice valves to each compartment containing a bailer. Crushed ant heap was most successfully used for stopping any small leaks against the shaft wall.

Routine of Blasting

Blasting was done with 24-ft. fuses, which were tied to the bottom set of timbers and lighted there. A man stood by each pump, and when the miners were ready

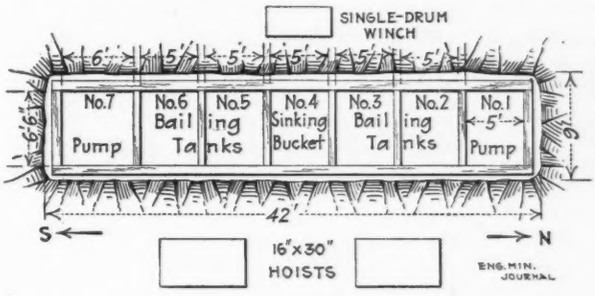

Fig. 1. Arrangement of Shaft during First Period

to spit the fuses, signals were given, the pumps stopped, suction joint levers raised, and the signal to hoist suctions given. On the pumps stopping, the bailing-ring gang went to the surface, and as soon as the suction started to move, the fuses were spit, and pump men and shaft men went to the surface in the sinking bucket.

No damage was ever done to the pumps by blasting, as the water over the holes prevented damage by rock, and the time was so short, between breaking suctions and blasting, that the water never quite reached the pump platforms. After blasting, the bottom set of timbers was examined, marks given to the hoisting engineers, and the two engines started bailing from the bottom until the bailing tanks no longer came up full. By this time, the pumps having been examined and tested, the drums were clutched in to serve the bailing ring and the remainder of the water got out. After blasting, it took about six hours to get the water out of the bottom, and so allow the shaft men to resume work.

In the table, the first seven months represent the work done during the first period. The quantities of water were estimated from the number of 600-gal. tanks pulled per hour while the shaft was being drilled. The shaft reached the bottom of the dolomite on Jan. 12, 1911, at

Note—An article by B. D. Bushell, entitled "Notes on Sinking Operations at the Springs Mines," reprinted from I. M. M. Bulletin No. 104.

605 ft., and work was started on the pump station at 650 ft.

Equipment for Second Sinking Period

For the second period the equipment was changed and increased. The headframe was extended over No. 1 compartment; a double-drum, geared engine was installed to handle 1000-gal. tanks through Nos. 1 and 2 compartments; and two 1000-gal. tanks with 24-ft. shoes were added. A double drum winch was installed to hoist rock from the pump station through No. 7 compartment, and

SUMMARY OF SINKING OPERATIONS

	Gal. Water per Day	Number Tanks per Hour per Engine	Footage Sunk per Month	Total Depth of Shaft	Average Daily Water Flow Gallons	Average Footage per Month
Aug., 1910	1,656,000	57.5	21	459 480		
Sept.	2,073,600	72.0	20	500		
Oct.	1,872,000	65.0	23	523	2,000,230	27.3
Nov.	2,304,000	80.0	41	564		
Dec.	2,102,400	73.0	19	583		
Jan., 1911	2,073,600	72.0	32	615		
Feb.	1,920,000	66.6	35	650		
Mar.	1,881,600	....	38	688		
Apr.	1,814,400	....	46	734		
May	1,710,000	....	52	786		
June	1,710,000	....	54	840	1,726,571	70.3
July	1,650,000	....	82	922		
Aug.	1,650,000	....	110	1032		
Sept.	1,650,000	....	110	1142		

false dividers and guides were set in No. 7 compartment, to allow this winch to operate.

This additional equipment was put into commission on Mar. 2, 1911. The ropes of the old North engine were deflected to operate in Nos. 3 and 4 compartments, the single-drum sinking winch was discarded and the South

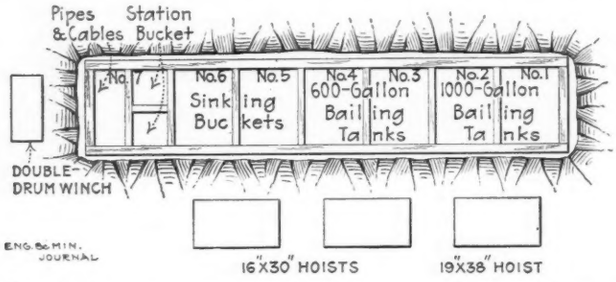

Fig. 2. Arrangement of Shaft during Second Period

engine equipped with sinking buckets. The object of the rearrangement was to relieve the tremendous strain on the bailing engines; to concentrate the water haulage at one end of the shaft and the rock haulage at the other end; and to release one engine exclusively for sinking, and provide another for use at the pump station.

Pump Chamber Cut

The plan of the shaft at the beginning of the second period was as shown in Fig. 2. The final ring below the fissure was put in at 619 ft., and all the water was bailed from this level. The actual pump-station level was 654 ft., or 35 ft. below the bottom ring. The pump-chamber portion of the station was completed by May 31, 1911, and a temporary centrifugal pump installed with its suction connected to the ring at 619 ft. This pump was driven electrically, had a capacity of 1,500,000 gal. per day under a head of 1000 ft., and, being situated at 654 ft., 35 ft. below its sump, was actually working under a head of 619 ft. With an overload of 10%, and the sixth stage of the pump replaced by a blank, the pump dealt with all the water comfortably, the quantity having, fortunately, decreased considerably after the shaft got below the fissure. This pump started on June 19, 1911, when the sump was scarcely begun, and, therefore, when the power went off, there was no storage for the water. This difficulty was got over by keeping the ring manned for bailing day and night, with the tanks stationed in front of the sluice valves, and it was found that bailing could be restarted in about three minutes. Occasionally, however, the ring ran over, extinguishing all the lights in the shaft bottom. This danger was relieved by installing a motor head-lamp connected with accumulators on the bottom set of timbers, thus insuring some light, at least, for the shaft men to get away by. When it is known that 70 natives and two white men constituted the shift in the bottom of the shaft, it speaks well for the efficiency of the system described that only once were the natives in any danger of drowning, and this occurred before the accumulator lamp was provided.

The whole station was completed, and the two permanent centrifugal pumps installed, by Sept. 30, 1911. In the table, the last seven months represent the second period. The number of tanks hauled with each engine is not given, as the tanks were then of different sizes; but, on the average, about 45 of the 1000-gal. tanks per hour were hoisted, the rest of the work being done by the 600-gal. tanks.

In conclusion, it might be of interest to mention that the permanent pumping plant was so satisfactory that no delay was caused in the shaft bottom on account of this water, and the only stoppage of the pumps was caused by the power supply being cut off. The average rate of progress in the shaft from September, 1911, to October, 1912, was 130 ft. per month. The reef was cut in the North shaft on Mar. 25, at a depth of 3432 ft. Development is now rapidly proceeding.

Wisconsin Orders on Shop Lighting

The following standards of shop lighting, recently ordered by the Wisconsin Industrial Commission (Vol. 2, No. 1), are based on the experience of reputable companies which have worked out their shop-lighting problems from the standpoint of efficiency and safety. In such factories where the proper standard of general illumination has been installed, it has been found unnecessary to use individual lights.

Order 2100. Natural Light Required. Each place of employment hereafter constructed must be supplied with adequate natural light during the working daylight hours.

Order 2101. Artificial Light Required. Each place of employment at present constructed and which is not so equipped as to furnish adequate natural light during the working daylight hours, must be supplied with artificial light as specified below.

Order 2102. Artificial Light Where No Gas or Smoke. Each place of employment in which hand or machine operations are performed, must be supplied during the working hours, when daylight is not available, with artificial light equivalent in amount, for each 4 sq.ft. of flood space, to not less than the light produced by a 1-cp. lamp hung 10 ft. from the floor.

Order 2103. Artificial Light Where Gas and Smoke. In foundries, forge shops and other industries where there is smoke and gas which obstruct the light, sufficient artificial light must be supplied to overcome the obstruction and to furnish the standard amount of light on the floor specified in order 2102. It has been found from experience in foundries and forge shops that the proper amount of light is secured when the standard of light specified in Order 2102 is increased 100 per cent.

Order 2104. Warehouses and Storage Places. Each place of employment in which hand or machine operations are not

performed, such as warehouses, vat rooms and storage places, must be supplied during working hours, when daylight is not available, with artificial light equivalent in amount for each 8 sq.ft. of floor space, to not less than the light produced by a 1-cp. lamp hung 10 ft. from the floor.

Order 2106. Yards, Roadways, etc. All yards, roadways, stairways, tramways and other places outside of buildings which are frequented by employees in the course of their employment, must be supplied with natural or artificial light during the working hours so that every part of such place is easily discernible

Notes—Reflectors for Lamps. Each lamp used for either general illumination or individual lighting should be equipped with a reflector made of white enameled steel, porcelain, glass or similar material which will not be tarnished by the gas and smoke, and which can be kept clean The reflectors used for general illumination should be so shaped as to concentrate and distribute the light on the working plane which is usually within 7 ft. of the floor. It has been found that a properly designed reflector will add about 35% to the efficiency of the lamp. These reflectors should be kept clean. It has been demonstrated that it adds from 35 to 50% to the efficiency of a reflector to keep it clean.

Walls Whitened, Windows Clean. In all places of employment where there is not excessive smoke and gas, the walls and ceilings should be kept properly whitened with paint or whitewash. It has been demonstrated that in departments where the walls are whitened the natural and artificial light is increased about 20%. It also adds materially to the natural light to keep the windows clean.

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Tigre Annual Report

The report of the Tigre Mining Co., S. A., and the Lucky Tiger-Combination Gold Mining Co., for 1912, are issued together. There were mined during the year 69,595 tons of ore with an average value of $24.27 per ton. Of this, 68,443 tons were milling ore with an average content of 0.137 oz. of gold, 28.02 oz. of silver; and 1152 tons were shipping ore with an average content of 1.011 oz. of gold and 348.9 oz. of silver. Including additional copper and lead content the total value of these classes were respectively $1,400,918 and $288,180. Beside the milling ore mined there were cyanided 14,615 tons of tailings from an old dump. Development during the year amounted to 4413 ft. The ore reserves on Jan. 1, 1913, are given as follows: 92,515 tons of ore in place, containing 0.11 oz. of gold and 36.6 oz. of silver; 54,892 tons of broken ore in the stopes containing 0.11 oz. of gold and 23.3 oz. of silver; and 5004 tons of ore on dumps containing 0.13 oz. of gold and 28 oz. of silver, in addition to which there are 66,000 tons of tailings dumps containing 0.08 oz. of gold, 13.5 oz. of silver. The total extraction of precious metal value contained in the ore during the year amounted to over 91%. The general operating conditions were good, considering the rebel movements.

Costs per ton for the year were as follows: Mining, $2.541; development, $0.715; transportation to mill, $0.112; milling, $4.809; general expenses, $0.738; marketing and taxes, ore and concentrates, $3.287; marketing and taxes, bullion, $0.784; giving a total of $12.986 per ton, equivalent to $903,772 on the year's production. Adding the cost of cyaniding the old dump tailings, $61,298, and deducting sundry profits of $35,928, gives total operating expenditures of $929,142. The cost of cyaniding these dump tailings was $3.486 per ton and of the marketin, $0.708 per ton. The receipts from sales were: On shipping ore, $288,195; on concentrates, $671,430; on bullion, $716,471. Commissions were $7878, making a total receipt of $1,683,974. In addition to the Mexican operating expenses, United States general expenses of $18,797 were incurred. Other expenses of interest, etc., were $32,194 and miscellaneous income was $7840, leaving a net realization from operations of $711,681. Depreciation on plant and equipment to the extent of $64,374 was written off and depreciation of mine property at the rate of $6 per ton on 69,595 tons equal to $417,570, leaving final net profits of $229,737. Dividends of $336,208.39 were paid during the year.

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Electro-Metallurgy in Scandinavia

Special Correspondence

The closing of the Hardanger Electric Iron & Steel Co.'s works after nine months' unsatisfactory working (Eng. & Min. Journ., May 17, 1913, p. 996) and the leasing of the company's waterpower plant (14,000 hp.) to French interests for a new industry (presumably phosphates) has practically solved the problem, so far as Norway is concerned, of electric iron smelting by the Electrometall system, with coke as a reducing agent. The production of pig iron by the Hardanger company during 1912, amounted to 2200 tons. Coincident with the above, the Arendal Fosse Co., which had planned the establishment of the same system of smelting, near Arendal, decided not to proceed with the undertaking.

A good deal of controversy has appeared in the Scandinavian technical press recently as to the failure of coke as a reducing agent when used in the Electrometall system. Many reasons are given, though generally speaking, the unequal distribution of heat in the smelting chamber, with consequent clogging effect on the ore, would appear to be the chief one, especially when slig or concentrate, is under treatment.

This alone would present an insuperable obstacle so far as Norway is concerned, for owing to the heavy freight charges over long distances, the delivery of a more or less concentrated and smeltable product is a *sinc qua non*. The Norwegian raw material, it should also be borne in mind, is essentially a concentrating ore. At Tinfos, in Telemarken, electric iron smelting is still in progress, and with coke as a reduction material; but the works, the Bie-Lorentgen, is stated to be of entirely different construction from that of the Electrometall. The output of the two plants at Tinfos is given at 10 tons of pig iron per 24 hr., and it is mentioned that the product has been regarded favorably both in Norway and abroad. As full particulars of the process are withheld, it is impossible to judge, at present, as to its economic possibilities on a large scale. At Jörpeland, near Stavanger, electric steel works have been constructed to turn out 4000 tons of steel per annum. But it should be noted that the raw material is mainly scrap and not ore.

Charcoal a Successful Reducing Agent

In Sweden where, as a result of initial experiments, coke has been rejected, the development of electrical smelting has been steadily maintained. The recent final report on Trollhätten results, while again unfavorable to the adoption of coke, lays particular stress on the excellent results obtained with charcoal, and more especially on the fact that the electric furnace required only a third of the quantity necessary in the ordinary furnace. Herein is an additional advantage in steel production, viz., the material reduction of charcoal costs. It is pointed out that in an ordinary blast furnace the consumption of charcoal is about 60 hectoliters per ton of iron, where-

as in the electric furnace it is only a little over 20 hectoliters. As regards electric power consumption, the final experiments reached 3.10 and 3.20 tons of iron per horsepower-year. In the earlier experiments the quantity obtained did not exceed 2.61 tons, with an average of 2.82 tons during the entire period. The electrode consumption was also satisfactory. During the 1910 trials, this amounted to an average of 13.8 kg. per ton of iron. At the Trollhätten trials, it had been reduced to an average of 4.85 kg., and at the last trials referred to it had gone down to 3.02 kg. Maintenance and repair costs were, so far as the smelting plant was concerned, also normal, and the iron produced was of prime quality.

The Electrometall company has applied to the Swedish government for a 40-year concession to operate the Luossavaara iron-ore deposits in Norrland. By an agreement between the state and the Luossavaara-Kiruna Bolag these ores are not exported, and in order to refine them economically, the site of smelting operations would have to be as near as practicable to the deposits.

In the proposed concession, sites for smelting works would be given near Kiruna railway station, and certain privileges and rebates as regards railway freights on ore are petitioned for. It is proposed that the state, as owner of the deposits, shall receive as royalty 1 krone, or 26.8c. per ton. The pig-iron product will, by the electric process, be of high quality for export purposes, and as a low phosphorus tenor is necessary, the Luossavaara ores are particularly suitable. It is estimated that by hurrying construction work, sufficient waterpower would be available at the beginning of 1915 to operate two smelting plants. These, with a capacity of 25,000 tons of pig iron annually, would require about 8500 electrical horsepower. Construction cost is estimated at 1,000,000 kröner, working capital 500,000 kröner, with a turn-over of about 2,000,000 kröner.

Large Increase in Ore Reserve

Both chambers have almost unanimously approved the government proposal for an increased export of the Grängesberg Bolag's ores in Norrland over a period of 20 years. The step has been taken in order to meet, in part, the outlay entailed by the old-age pension fund. The increased output will, it is estimated, bring in an amount of about 238,000,000 kröner. The state as part owner, and by virtue of an agreement with the Grängesberg Bolag, has a controlling voice in the destinies of the Norrland deposits, and it has hitherto restricted the export of the ore in the fear that the reserves would be prematurely exhausted. Lately, however, exploitation has shown that these reserves are far larger than has generally been believed. In 1908 they were estimated at 593,000,000 tons, whereas at present 973,000,000 tons are computed to be nearer the actual quantity. By the new arrangement the export from 1912 to 1932 will be increased from 102,000,000 to 133,000,000 tons, an increase which is by no means in proportion to the increased estimated reserves. The export from the Kiruna deposits for the 20 years will thus be augmented by 31,000,000 tons, and on the principle that the profits will be equally divided between the original and preference shareholders, the state, as preference shareholder, takes one-half of the profits.

A clause in the agreement betwen the Grängesberg Bolag and the state is to the effect that the former shall undertake a series of deep borings for exploitation purposes at a cost of 500,000 kröner, the amount to be refunded by the state in 1932 or 1942 should it decide to take over the deposits. Both chambers finally voted a sum of 500,000 kröner for new rolling stock for ore transport, 1,000,000 kröner for regulating of the Stora Lule River, and 160,000 kröner for strengthening the Porjus-Gellivaara-Kiruna power transmission.

Swedish Iron Dependent on German Manufactories

It is thought that the Swedish government, apart from old-age pension requirements, has also had in view the possibility that the Swedish iron-ore export would be seriously threatened if it were not increased to keep pace with German requirements. The ore goes, in the main, to German smelters, whose steel production is based on the Thomas process. It is feared that should Sweden not meet the increasing demand for ore, it may lead to the entire alteration of the present German system of steel production, thus opening the door to competition with ores low in phosphorus, and especially those from the immense deposits in Brazil. It is more than probable also that the charcoal question has had its influence on the government's decision, for certain it is that the claims of the smelters and the pulp mills have sent up the price of the home article considerably in recent years. The present price of charcoal in middle Sweden is nearly 40 kröner per ton, whereas in 1909, it was 36 kröner, and not so very long ago, 25 kröner. At 36 kröner per ton, the charcoal cost was 47% of the production cost of the iron. At 40 kröner, it is about half. The fact that the home production of iron takes a yearly toll of seven-eighths of Sweden's charcoal production must have had some weight with the authorities concerned. There is no doubt that the thinning out of the forests along the rivers, the improvements in communication, and the demands of the pulp and cellulose factories, and the timber trade generally are responsible for the increased, and still increasing, price of charcoal in Sweden.

The directors' report for 1912 of the Sydvaranger iron mines, Norway, states that at the end of that year the second construction period (for an export of about 500,000 tons of ore) was practically closed and the extension put into operation. In the meantime the demand for the company's products had called for an increase of the share capital by 3 million kröner, in order thereby to get a production capacity of 650,000 tons. The amount had been subscribed by Norwegian interests, and the share capital was now 15 million kröner. Deep bores had been made provisionally on the Björnevand deposits, and at a depth of 235 meters (about 70 meters below sea level) core analyses had shown a higher iron percentage than was hitherto expected. Work during the year had gone on systematically, though hampered to some extent by unforseen causes, such as a week's strike, a couple of stoppages in the electrical department and some disturbance of shipping arrangements. As a consequence, about 150,000 tons of briquettes, and about 92,000 tons of slig (dry weight), in all about 242,500 tons, of product were exported. As the year was also a construction year with a relatively small export, the results, as would be expected, were negative so far as profits were concerned. A number of men employed at the Sydvaranger mines was about 850 in the first half and 1100 in the second half of the year.

The construction of the second large power station for nitrate of lime manufacture (Rjukan II) near Notodden, Telemarken, will, it is expected, be completed during 1916. The development will be 140,000 hp., which in addition to that of Rjukan I, completed some two years ago, will give a total of 280,000 hp. The construction cost of the two works will amount to 60,000,000 kröner. Recent experiments have shown that the nitrous anhydride of the synthetic process is capable of being condensed to a consistency suitable for the manufacture of explosives. It is therefore the intention of the company to take up this branch of industry in addition to the nitrate for manurial purposes.

The Swedish department of finance in its report on the capitalized value of the national resources has estimated the amount of waterpower available during the coming 50 years at 3,500,000 hp., of which 3,000,000 are in private hands and 500,000 the property of the state. Capitalized, this, it is estimated, would amount to 138,500,000 kröner, of which 109,500,000 kröner would be in private hands and 29,000,000 kröner state property. The great majority of the falls are in Norrland and Dalarne. The total of the falls is scarcely 1% of the capitalized value of the country's assets, which are estimated at about 14,000,000,000 kröner.

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Trinity Gold Mining & Reduction Co.

The report of the Trinity Gold Mining & Reduction Co., of California, for the year ended Nov. 30, 1912, shows that the indebtedness of the company was reduced from $154,392 to $75,042. Disbursements during the year were: For ore development, $10,782; cyanide plant, refining, building, road and tramway, $2759. On equipment investment there was a reduction of $1236, which resulted from the sale of an auto truck for $1400 and the expenditure of $164 for live stock. The mining, milling and other supplies now on hand amount to $9664 and the entire amount of bullion produced has been disposed of. The amount of cash on hand is $14,402. Net earnings for the period amounted to $38,533, which sum added to the amount of the earned surplus accrued at the end of 1911 brings the total earned surplus up to the sum of $104,797.

The ore-bearing lode, which may be described as a flat-lying body about 40 ft. in thickness, as disclosed by numerous strong outcroppings and in mountain slides, has been extensively proved by development work.

More than a year's time has been spent in accumulating data, and so thoroughly has the continuity of this open or exposed orebody been asserted by the many disinterested engineers who examine the property, including those acting for the company, that it is a matter of distinct surprise to find that the orebody is not continuous, and that the reserve contains neither the quantity of ore nor the value in money which had been represented. The manager reports that for this reason the plant was closed down until such time as more extensive development work shall make available bodies of ore large enough to supply the mill continuously, and, thereby enable it to operate profitably.

Immediately after the opening of the spring season of 1913, the president, or a committee of the board, will be sent to the property in company with the general manager to make inspection of these later developments and form a plan of future development and other mining operations. In the orebody at present exposed there is perhaps 75,000 to 100,000 tons of sulphide ore of the value of approximately $4.50 per ton in gold, half an ounce of silver and from ½ to 2% copper, which with a workable process ought to be profitably treated. The company's works at present are not adapted to the treatment of sulphide ores.

The total operating expense at mine and mill amounted to $129,032 and expenses at the New York office, $7818, a total expense for the year of $136,850. Sales of bullion and electric power to other companies amounted to $175,383, leaving a net profit for the year of $38,532. Up to Aug. 1, 26,600 tons of ore having an average value of $4.36 per ton were milled, the average extraction being 81.82 per cent., and mill costs were $1.015 per ton as against $1 for the seven months previous. The total operating cost, including mining, was $2.447 per ton, the advance over figures on last year's reports being due to the ever increasing expense of obtaining clean ore.

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Consolidated Coppermines Co.

The Consolidated Coppermines Co., as already noted in the JOURNAL of May 31, 1913, p. 1123, is a new Delaware corporation with an authorized capital of 1,600,000 shares at $5 par, which is to take over the Giroux, Coppermines, Butte & Ely, and Chainman companies in the Ely district, by exchange of stock. The following will be the shares of stock in the old companies exchangeable for one share in the new: Giroux, 2½; Coppermines, 3⅛; Butte & Ely, 6¼; and Chainman, 25. This offer closes on June 30, and every stockholder of record on July 5, will, until July 31, have the privilege of subscribing at par, *pro rata* to his shares, to a 15-year 7% convertible-bond issue, not to exceed $3,000,000.

It is understood that large applications have been made for that proportion of the new bonds not taken by stockholders. Until the physical properties are taken over, the cash received from this bond issue will be loaned or advanced by the Consolidated company to the subsidiaries as needed by them.

The incorporation of the Consolidated company and the offer of exchange are the result of recommendations by Edwin F. Gray, who had charge of the Nevada Consolidated Copper Co. in its early stages, and A. J. Sale, general mining engineer of the Giroux company.

The properties to be consolidated embrace 160 mining claims in the Ely district, which cover nearly all the developed and partially developed properties there except those of the Nevada Consolidated, and several ranches, covering 4445 acres, which control valuable water rights. The water in Steptoe Creek is now controlled two-ninths by Giroux and seven-ninths by the Coppermines company, and is the only available water having gravity flow. Of this there will be enough, under a 500-ft. head, to care for 10,000 tons per day of concentrator capacity.

The Giroux and Coppermines properties are both producers, Giroux having for the latter part of 1912, and the first of this year, produced 900 to 1200 tons of 2% ore daily. However, by the time such ores have paid concentrating, smelting and refining tolls to custom plants there is little for the original owner. None of the properties has singly enough ore developed or likely to be developed

to warrant an extensive reduction works, and the only hope of developing extensive enough orebodies to warrant a plant was in this present consolidation.

The expectation is to finance the development of the company through the current assets and the new bond issue, and to push development until at least 30,000,000 tons of ore are blocked out. Mr. Gray is of the opinion, from his experience with the old Ruth mine (now in the Nevada Consolidated), that the area covered by the new consolidation has hardly been prospected, and that a great tonnage can be cheaply developed here.

In the meanwhile tests of all possible treatments will be made, in the hope of getting some method which will give higher returns than the methods now in use by the various porphyry mines.

Looking toward the future, the acquirement of the Chainman mine was desirable as this is the only one of the four which has any quantity of iron ore, which will be a necessity for smelting operations.

The Giroux has 1,441,420 shares outstanding, also $292,000 first-mortgage 6% convertible bonds, and a floating indebtedness of approximately $300,000, the latter item being practically offset by cash, matte, and other quick assets. The Coppermines company has 381,178 shares outstanding, and a floating indebtedness of approximately $80,000. The Butte & Ely has 250,000 shares not owned by Giroux, and it is only these which are to be purchased. It has no indebtedness, and about $240,000 of quick assets. The Chainman company has 860,821 shares outstanding, and a floating indebtedness of about $3000. When the exchange is made the new company will have outstanding $3,862,840 par value of stock.

The officers of the new company will be Charles F. Rand, president; Erastus T. Tefft, vice-president; Charles F. Smith, secretary-treasurer; Edwin F. Gray, general manager; and Thomas F. Cole, Joseph B. Cotton, Isadore Hernsheim, William B. Joyce, Ralph C. Lupton, Mulford Martin, C. Lawrence Perkins, James Phillips, Jr., Charles F. Rand, W. Hinckle Smith, Erastus T. Tefft and William B. Thompson, directors. Messrs. Martin, Phillips, Smith and Thompson will all be recognized as being, like Mr. Gray, men familiar with the Ely district.

Mining in South China

A report from United States Consul General G. E. Anderson, at Shanghai, notes that a considerable revival of mining enterprises in South China districts near Hongkong seems to be going on, mostly in the southern portion of Kwangtung and in Kwangsi provinces. These provinces are known to contain gold and silver, as well as antimony, which is already mined; tin, which is mined in a crude way to a small extent, and other and less valuable metals. The prospects of mining and the activity of prospecting has led to the establishment of an assay office in Hongkong by an American-trained Chinese mining engineer.

Several mining undertakings of some note are now in hand by native companies. One, operating for gold and other metals in Kwangsi Province, recently put in considerable pumping and other machinery, mostly of American make. Another Canton concern, with an American-trained mining engineer for manager, is operating for gold and has recently put in a stamp mill and other American machinery. A Hongkong company is planning operations in the southeastern portion of Kwangsi. There is prospect of active mining work being undertaken this summer in Hunan Province. A large company has been formed and proposes to open a coal mine and also to undertake mining for tin, lead, gold, silver and other metals.

Annual Report of the Bureau of Mines

The second annual report of the director of the U. S. Bureau of Mines, while devoted largely to the work accomplished in the coal-mining field, notes also the work done along metal-mining lines, and outlines projected work for the future.

Studies of mine accidents, blasting explosives, mine fires, fuel-testing methods, etc., apply to metal mining as well as coal mining. Work more specifically related to metal mining was also done. Shortly before the close of the fiscal year of 1912, the Bureau established an office in San Francisco, to study the problem of smeltery fumes, particularly their effect on government property. Work was conducted at Cambridge and Pittsburgh, looking to the possibility of reducing iron ore by means of crude oil, with the two-fold purpose of making possible the treatment of Pacific Coast iron ore, and of utilizing residual petroleum. Plans have been formulated for the collection of information on different types of metallurgical furnaces, with the special object of evolving less wasteful methods of treatment, investigating the treatment of complex sulphides, extracting the rare metals used in making steel, etc. Some studies were made in the Joplin district on the efficiency and the losses in ore dressing. A study of the titaniferous magnetites, looking to their more general utilization, is in progress. An inquiry into the safety, efficiency and economy of mine-tunneling methods is under way. Other subjects under investigations are, safety and efficiency in various branches of mineral industry, occupational diseases, the utilization of mica and feldspar, the nature of slimes and clay colloids, the rare minerals possibly capable of extraction from United States ores, possible valuable content in the tailings of placer washings, brass and other nonferrous alloys, etc.

Important reports, now well under way, are the following: (1) Iron Mining in the United States, by Dwight E. Woodbridge; (2) The Iron and Steel Industry in the United States, by John Birkinbine; (3) The Smelter Industry in the United States, by C. H. Fulton; (4) The Sampling, Testing and Assaying of Ores and Metallurgical Products, by W. J. Sharwood, T. R. Woodbridge and Edward Keller; (5) Safety and Efficiency in American Tunneling, by D. W. Brunton and J. A. Davis.

Data are now being brought together for similar reports on the quarry industry, the lead and zinc industry, the copper industry, the precious-metal industry, the coal industry, the petroleum industry and miscellaneous mineral industries.

An examination of mining laws and of mine-accident statistics, of both this country and other countries, is being conducted with the idea of assisting state legislatures in framing laws which will lessen mining fatalities, and increase the health, safety and comfort of the mine worker.

CORRESPONDENCE AND DISCUSSION

The Institute Land Fund

For the information of the members of the Institute, Doctor Douglas has sent the following letter to the Secretary:

Bradley Stoughton, Esq., Secretary,
American Institute of Mining Engineers,
29 West 39th St., New York.

I have pleasure in making the following statement concerning subscriptions to the Land Fund of the American Institute of Mining Engineers up to June 1, 1913:

Amount of land debt unsubscribed Aug. 2, 1912.....	$68,000
Amount subscribed in response to my requests.....	68,000
Amount so far collected.....	48,405.22
Amount at present uncollected.....	19,594.78

Of the uncollected balance, $17,639.75 is due by men who subscribed $1000 or more; $1010 is due by men who subscribed $100 to $1000, and $945.03 is due by men who subscribed less than $100.

In order that the full amount might be reported at the annual meeting of the Institute as having been subscribed, certain members who had already contributed liberally subscribed the balance not then subscribed for. Since that time a number of subscriptions have been received and others are expected so that I hope that the guarantors will not have to be called upon for their additional donations

Now that the dues will not have to be raised in order to relieve the Institute of debt I hope that many of the members who hesitated to subscribe to the fund while the result was still doubtful will contribute their share.

Yours very truly,
JAMES DOUGLAS.

June 4, 1913

Copper Smelting at Chrome, N. Y.

I have read with interest Richard H. Vail's article on the Chrome smelting plant, appearing in the JOURNAL for May 24, 1913, especially the part concerning the nodulizing of the flue dust and the production of a ferrosilicate slag. Nodulizing flue dust is new to me, but making ferrosilicate slag and selling it for its iron contents has been done for many years in the Eastern copper-smelting business.

An analysis is given of an iron slag SiO_2, 25.2% (insoluble 29.9%); FeO, 59.8%; CaO, 0.7%; Cu, 0.79%, but the grade of matte made at the same time as this slag is not given. He says that the matte varies between 40 and 70% Cu, the average of which would be 55%. Suppose, then, assuming an average slag, with a 55% Cu matte there is a slag loss of 0.79% Cu. This I believe to be exceptional. After many years' experience in running ferrosilicate slags with and without small amounts of lime, I have found it impossible to average any such low copper losses. Either the slag is incorrectly analyzed by not properly checking the titration results with the battery, or the slag is not accurately and fairly sampled nor properly chilled.

In looking over these analyses this last statement is borne out. There is a large discrepancy between the SiO_2 and the insoluble. There should not be a difference of more than 1.5% or 2% at the most. One analysis shows a difference of 4.7% and the other 4.4%. I wonder what the ferrosilicate slag would run in Cu when the matte assayed 70% Cu. With the slag mentioned, the high grade of matte and a heavy matte fall (say, 14%) my experience has shown that when making such a ferrosilicate slag, it will average 0.85% Cu even if the furnace is run with a reducing atmosphere.

The other slag mentioned as being run when not selling it for its iron contents is also of interest. In spite of the fact of the abundance of copper-bearing iron material it seems to me that it would pay to run a slag SiO_2, 35%; FeO, 45%; CaO, 4%. Here only a little more lime is used, 10% more SiO_2 and a slag would be produced running, with a 55% Cu matte (the average grade as mentioned), about 0.55% Cu. If the siliceous ores carry 50% SiO_2, then 20% more ore could be smelted, 0.25% Cu could be saved in the slag or 0.25% of 200 tons slag or ½ ton Cu per day with its silver and gold contents, probably worth $350 per ton.

The statement is made that the large amount of Cu on the charge, the high grade of matte and the high specific gravity of the slag accounts in part for the high copper loss. I would like to ask the author if he ever ran a ferrosilicate slag with a 30 to 40% matte and kept an accurate record of the slag losses. How are the high slag losses accounted for on most of the slag dumps? Slag losses depend on many things, such as the percentage of coke, volume and pressure of air, inclination of tuyeres, depth of bosh, inclination of jackets, depth of crucible, percentage of sulphur on charge, depth of ore column and the general condition of the furnace, such as bright tuyeres, hot or cold top and whether the furnace is running oxidizing or reducing.

The fluid converter slag is poured directly into the blast-furnace settler. I wonder if the slag which ran 0.79% Cu was taken directly before or after a ladle of hot converter slag was poured into the settler. It would be interesting to have a series of samples taken every minute from 5 min. before the converter slag was poured until 5 min. after the operation of pouring was completed, and compare these results with the analyses of the blast-furnace slag taken under normal running conditions. It would be also interesting to have a series of samples taken from the mouth of the converter during the operation of skimming the converter. I am curious to know if any experiments were made at Chrome to determine the chemical form in which the copper occurs in the converter slag. I think if these samples were taken and experiments were made, there would be a modification of the metallurgical procedure there. This operation of pouring fluid converter slag, made from a high-grade matte, (where the converter blows only a short time before the charge is up to blue metal or white metal) into a settler is analogous to an experiment we performed once. We were running a black-copper furnace making copper assaying 96% Cu. The slags were a little (?) over 1% Cu and the superintendent determined to recover some of it. He lined a large settler, 12 ft. in diameter, with several hundred dollars' worth of basic bricks and ran the slags from the black-copper furnace (internal

crucible) into it. Needless to say no appreciable amount of copper settled out and the experiment was a failure. To this day I believe the superintendent remains in ignorance of the reason why he could not settle out some of the copper in the black-copper slag.

JOHN W. JAMES.

New York, June 2, 1913.

Cost of Brazilian Iron Ores

J. R. Finlay recently read a paper at the American Institute of Mining Engineers (ENG. AND MIN. JOURN., March 1, 1913, p. 477), in which he calculates the cost of Brazilian iron ore. He says, after speaking of Cuba, "The only other field which can reckon on billions of tons of iron ore is Brazil."

In speaking of Brazilian iron ore, he takes for his basis of calculation, the ore in its natural state as containing 62% iron. The fact is that for many years the shipments will not fall below 68% iron, and this extraordinary purity will command a high premium per unit of iron not allowed for in his calculations, and represented by at least 33c. per unit. He figures out the land haul at 0.66c. per ton-mile, and sea haul at 0.09c. per ton-mile, and makes the cost of Brazilian iron ore landed at Pittsburgh as follows:

	C. per Unit
Mining—25c. per ton	0.40
Land haul —380 miles Brazilian land, 350 miles American land	
730 miles at 0.66c.	7.77
Sea haul, 5700 miles at 0.09c.	8.27
Total cost per unit laid down in Pittsburgh	16.44

As he figures on a 350-mile haul from the sea to Pittsburgh, the cost per unit of iron at American ports would be:

	C. per Unit
Mining	0.40
Land haul 320 miles at 66c.	3.40
Sea haul	8.27
Cost per unit of iron at sea port, American	12.07

He then goes on to say: "Comparing this with the Lake base cost per unit of 5.93c. plus a bessemer differential in favor of Brazilian of 1.00 leaves a net differential at Pittsburgh in favor of Lake ores of 9.51," and further, "Brazil cannot compete at any point in the United States." It has never been pretended that Brazilian ore could be sent to Pittsburgh at a profit to compete with Lake ore. This is apparent on the face of it, but these ores will certainly compete with Lake ores at the American sea coast or with imported ores from other regions.

Working out his figures to cost per ton, which are more intelligible to the ordinary mind, we have as the cost of Brazilian ore at Pittsburgh:

	Cost per Ton, Dollars
Mining	$0.25
Land haul (730 miles)	4.81
Sea haul	5.12
Cost of ore in Pittsburgh, according to Finlay	$10.18

The above calculation is, however, erroneous. Mining will cost 50c. per ton, as the ore is hard and it will have to be crushed.

In regard to land haul, however, the Brazilian Central Ry., a state-owned company, has contracted to haul ore over 650 km. (the distance of the mines from the sea) for 8 reis per kilometer per ton, which in American money equals 0.43c. per ton-mile (not 0.66c. per ton-mile as Finlay figures), or $1.75 per ton for the entire haul.

The government has specified that it will grant the guarantee of interest on the cost of the Victoria-Diamantura railroad only upon the condition that it carry iron ore for 10 reis per kilometer per ton, which is equal to 0.53c. per ton-mile, or $2.14 on the whole distance.

Regarding sea freight, at present there is exported from Brazil 250,000 tons of manganese ore, on which the average freight to Europe and American ports is 12s. 6d. per ton. Just at present such a rate is low, owing to the shipping boom, but in ordinary times this can be obtained, and Diesel-engined ore boats could do it at 10s. per ton, as they would bring out coal at good remunerative rates. The costs then are:

	Cost per Ton
Mining	$0.50
Land freight	2.14
Sea freight	3.00
	$5.64

Grade of ore 68%. Cost per unit—8.29c.
(Besides the premium on pure ores).

Cuban ores Finlay calculates at $4.68 laid at American ports, with 52% iron or 9c. per unit of iron. (No value being given to the nickel contents.) Finlay calculates the average cost of Lake ore laid down at Pittsburgh at 6.26c. per unit, or on 52% ore, a cost of $3.25, f.o.b. Pittsburgh, to which must be added $2.50 to convey the ore to the sea, making at the American seaboard a total cost of $5.75 per ton, or 11.06c. per unit of iron.

Hence Cuban ores are cheaper at the seaboard than Lake ores, but Cuban ores are dearer per unit of iron than Brazilian ores will be in the near future. Further, hard, lumpy ore of such extraordinary purity will command probably a dollar per ton premium. With 62% ore Finlay allows 62c. per ton, but a 68% ore is vastly better than a 62% ore.

There are companies which offer special terms for such ore, owing to its purity, hard lumpy character, and freedom from moisture. No ore in any part of the world can compare with it.

WILLIAM JONES.

Mina Santa Bento, Barra de Santa Barbara, Minas Geraes, Brazil, Apr. 18, 1913.

Ammonia in Lead Furnace Flue Dust

While working in the briquetting plant at the Aguascalientes smelting plant in Mexico several years ago, I noticed that whenever flue dust from the lead furnaces was being made into briquettes in the Chisholm-Boyd-White machines, with the addition of from 6% to 20% of slaked lime as a binder, the presence of fumes of ammonia was most pronounced.

At that time Thomas S. Austin was general superintendent of the Southern Division of the American Smelting & Refining Co., and his explanation of the presence of ammonia in the flue dust was, that the nitrogen in the air became combined with hydrogen in the blast furnaces so as to form ammoniacal compounds.

Just how nitrogen can be converted into ammonia salts in the blast furnace is not readily apparent, and it might be of interest, if other readers of the JOURNAL, who have observed the presence of ammonia in lead-furnace flue dust, would give their opinions as to the origin of that compound in such material.

C. CARLETON SEMPLE.

New York, June 7, 1913.

EDITORIALS

The Position of the Metals

The copper refiners' statistics for May again show a large decrease and the American stock of refined copper now stands at only about 67,000,000 lb., which is not much more than the ordinary working stock that must be on hand always. Of the stock on hand only about 42,000,000 lb. is electrolytic, which means that the refiners are practically bare of the most important class of copper. The production was a little larger than in the previous month, but not much, and as we have pointed out many times the figures of a single month are without any great meaning. The large decreases in stocks, both in Europe and America, which occurred in May, confirm the ideas that have previously been held respecting the strong statistical position of copper. At the end of May the European stock was only 77,000,000 lb., this being a decrease of 8,500,000 lb. for the month on that side of the ocean.

The price has slumped off about ¾c. per lb. in the absence of any important buying demand for the moment. The producers are filling contracts that run into July and longer, and until their orders are more nearly filled there is neither need nor desire on the part of most of them to force any copper on the market. If copper consumption be maintained, there will be an upward movement in this market when buyers have next to place their orders, but unfortunately there is a well founded fear that the rate of consumption will fall off this summer.

The lead market is for the moment stronger than any other. The deficiency in the supply abroad keeps the price up over there and also here, inasmuch as Europe would take lead from us if we should go off to any considerable extent. With lead in London at about 4.35c. and at the same price here, the market is already hovering at the export point.

In spelter the situation is the reverse, the European market being weak. The smelters there have been in receipt of bountiful ore supplies, especially from Australia, have increased their smelting capacity and have indulged in an overproduction which has resulted in a large accumulation of spelter on their hands. American smelters have done somewhat the same thing, but they were successful in getting the stock into the hands of the consumer, although this does not now appear to have been so fortunate a proceeding as it seemed to be during 1912. The fact that this resulted from a misapprehension of conditions may increase the disappointment, but does not alter the present situation.

The point that needs to be made clear is that spelter is suffering from an ill that is peculiar to itself and in no way reflective of the conditions governing the metal trades in general. The European price will probably go off some more and our price along with it in view of the expectation that the tariff on this metal will be reduced to about 0.5c. per lb. If the tariff bill is passed, we shall probably import some spelter, relieving the situation in Europe, after which, no doubt, there will soon be a recovery, inasmuch as it is doubtful if American mines can supply the domestic demand with spelter holding under 5c. per lb., while the European price cannot go under 4½c. without making it very uncomfortable for the Australian producers. A change in the spelter situation is chiefly a matter of the absorption of the stocks that have accumulated.

The pig-iron market apparently suffers from the financial situation that is so seriously checking new construction, and the price naturally sags off while the production is still maintained at a large rate. When money cannot be obtained at rates that builders are willing to pay, the demand for the commodities that they contemplated using is postponed. In view of this recognized condition, it is surprising that the consumption of copper is so well maintained, but even in the steel business itself conditions are irregular, the price for tubes going up while the price for some other forms is going down.

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Safety First with the Inland Steel Co.

The Inland Steel Co. is a mining and metallurgical organization with iron mines on the Mesabi range and furnaces at Indiana Harbor, Ind. It is a progressive and successful concern and its success has not been won at the expense of the lives and safety of its employees. The Inland Steel Co. in fact, devotes a degree of attention to the promotion of safety about its works sufficiently out of the ordinary to deserve rather extended mention.

An examination of the books of safety rules, distributed to its employees, reveals the fact that the diminution of accident rates is to the company actually a matter of vital concern. It is a relatively simple matter to formulate and publish codes of rules and regulations. It is quite another matter to enforce them so that they become actively effective. It is particularly difficult when their operation means in one way or another direct pecuniary loss to the company. There is no blinking the fact that safety rules do in their immediate effects increase operating costs and it is a severe test of highmindedness to submit voluntarily to their operation and depend on rather remote compensations. This, however, the Inland Steel Co. appears to do.

We quote from the preface of the book of rules as to how enforcement is obtained:

> **If you are not willing to give your hearty coöperation and live up to these rules and regulations, we wish you would voluntarily leave the employ of the company, for if we discover anyone intentionally violating them his employment will be summarily ended. Every superintendent, foreman or person having authority over employees, is hereby directed to compel those under him to obey these rules, and to exercise such discipline and penalties as may seem reasonable. It is not intended that everyone who may unknowingly and unintentionally disobey a rule shall be immediately discharged; however, he should be made to realize the error of his ways and that he is under observation. If observation indicates he is of such a disposition as to show a disinclination to obey the rules and give his best efforts for the safety of himself and others, he should be discharged at once. We**

do not want any heedless or careless men in the employ of the company. While every man is hired to do some particular work, the safety of himself and fellow men is vastly more important than that work. The care exercised by all employees to prevent accidents will have due consideration in connection with their retention and promotion. In times of business depression when it is necessary to reduce the force, the workmen with the best records for carefulness in the prevention of accidents to themselves and others, will be given employment in preference to others. Employees, who have, through their own carelessness, caused injury to themselves or others on more than one occasion, are likely to be discharged.

Evidently promotion and even retention in the employ of the company are made contingent on the observance of safety rules.

Safety committees have been formed under the direction of foremen and monthly bulletins are published, showing results accomplished, commending departments and individuals, describing accidents and recommending means of prevention. As evidence of its sincerity and earnestness, the company has established a scheme of voluntary compensation for injured employees and those dependent on employees who are killed. The provisions of this relief plan are exceedingly generous, being equal or superior to those of the usual workingmen's compensation act. No reservations to cover the carelessness of fellow servants, assumption of risk, contributory negligence, etc., are inserted. The compensations provided, favor married employees and those long in the service of the company. In general, they are extremely generous.

The specific rules provided for the prevention of accidents are not all new, but they are all good. Many of them are applicable to mining and metallurgical work of all kinds. Their excellence and general applicability is such that it is the intention of the JOURNAL to publish from time to time some of those most valuable. We commend the aims and methods of the Inland Steel Co. as worthy of imitation by all operators in related fields.

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The West Virginia Conspiracy

The peculiar indictment for conspiracy found by a United States grand jury in West Virginia is the first of the kind on record, and is another step in the extraordinary proceedings resorted to for the suppression of the miners' strike there. In brief, the indictment charges that certain officers and members of the United Mine Workers combined with certain mine operators of other states to organize the miners of West Virginia and bring them into the United Mine Workers. The ultimate object of the conspiracy as charged was to increase the cost of mining West Virginia coal and thereby to decrease its advantages in competing for trade.

The fact that the miners of West Virginia are for the most part unorganized and that wages in the mines have been lower than elsewhere, has undoubtedly been a thorn in the flesh of the operators who work under the so called tri-state agreement with the miners. Under that agreement, the mining wage scales have been advanced from year to year, as the demands of the United Mine Workers increased. In West Virginia there have been only slight advances, and the operators have been able to force their coal on the western markets and the Lake trade, notwithstanding the drawbacks of greater distance and higher freight rates. This feeling has been emphasized by the fact that several times when the frequently recurring disputes over the wage scale brought about strikes or stoppages of mining, the West Virginia operators pushed in, taking trade wherever they could get it, and in many cases holding it permanently. The quality of most of the West Virginia coals is good, and this helps to get and secure a market wherever the difference in freight rates is not enough to hold them back. The United Mine Workers are equally anxious to do away with an influence which has more than once brought them to terms in case of a strike.

So far the motives for action by both parties exist, as can readily be seen. But agreement on any point, while it may constitute a motive, does not constitute a conspiracy, and much further evidence will be needed before the existence of such an unlawful combination can be proved. Of course, the indicted parties vehemently deny the charges. The Mine Workers' representatives urge that the strikes were inevitable and were due to the low wages, the iniquitous company-store system and other oppressions of the operators. It so happens that a great deal of public attention has lately been called to mining conditions in West Virginia and to the violent measures taken to repress any attempt of the miners to organize or to better their condition. So far as the public is concerned, the new proceeding is likely to be regarded as another attempt to put the law on the side of the oppressor and to meet with no public support.

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Hearsay Evidence

The Government's suit against the U. S. Steel Corporation drags on its weary course, but is producing a lot of testimony that is creating a very favorable impression in behalf of the company. No one who has ever been injured by the Steel Corporation seems to have been found, and, on the other hand, it has manifestly been of a great deal of benefit. The original complaint was characterized by somebody as being a combination of a poem, a political document and a bill in equity, which does not seem to be far out of the way as the case is developed.

Jacob M. Dickinson, who is conducting the case for the government, displays a pettifogging disposition. Mr. Farrell, president of the company, recently testified to a great many figures relating to its business. On cross-examination Mr. Farrell testified that the statistics were prepared at his direction in the controller's office.

"Can you state from your own knowledge, independent of your faith in the controller's office, that these figures are accurate?" asked Mr. Dickinson.

"Well, I don't know much about the ethics of this matter," replied Mr. Farrell, "but if you want me to say that I have personal knowledge of every single item in all that data, why, of course, I must admit I can't. I believe they were substantially correct because the foreign business is one with which I am intimately familiar."

Mr. Dickinson objected to the statistics on the ground that they were "hearsay evidence." Mr. Dickinson raised the same objection to the testimony of another witness. This is, no doubt, sound in law, but what is the use? Carrying this theory further, no one might legally testify as to the production of pig iron in the United States unless he had personally collected the statistics and a mining engineer might not testify as to the value of a mine unless he had personally taken all the samples and assayed them. If common sense had more rein in the courtroom, trials would not be so long.

BY THE WAY

The story is told of an engineer who complained that recent shipments of coal had fallen off in quality. He insisted on an explanation, says *Power,* and the coal dealer informed him as follows: "Most of my customers up your way purchase their coal on a heat-value basis and, of course, they rejected this last lot, so I had to send it to you, as I know you purchase without testing."

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Chicago, Milwaukee & St. Paul Ry. officials say that complete reports on the 5000 tons of steel rails, which the company ordered last year with an alloy of 0.6% copper, which were laid in various sections of the system, principally in the Northwest, show that not one broken rail has been found in the lot. This is considered a remarkable showing. The company has ordered 10,000 more tons of the same copper-steel rails, and if the result is similar, will adopt this rail as its standard.

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Charles M. Schwab was a frank and willing witness in the hearing in the Government suit against the Steel Corporation and in his direct testimony gave evidence which tended to absolve the corporation from all charges brought against it. He declared that the corporation is no monopoly; that it does not restrain trade; that it cannot put an independent out of business, particularly the Bethlehem Steel Co., of which he is the principal owner and executive head; that it never ruthlessly fixed prices or cut prices, and that it did not deliberately dismantle mills, buy out competition or crush it out.

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The use of transits in the Cornwall mines is practically impossible, according to H. G. Henderson, discussing in *Bull.* 102 of the Institution of Mining and Metallurgy, a paper by L. H. Cooke on "Specifications of Theodolites for Mines." The reason for this lies in the small shafts and narrow tortuous levels and other workings. Two-wire plumbing in the shafts is useless since the space between the two wires is too short to give any accuracy, and underground workings must be taken off from a single point, using some form of magnetic needle. Consequently the compass, the miner's dial and the "rapid traverser" are the popular instruments for underground use in that old and honorable mining country.

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The mining engineering profession is accustomed to consider the use of high explosives as its especial field. It is probably not generally realized how widely explosives are used otherwise. Disregarding the strictly engineering work of excavation in rock or compact material on a considerable scale, explosives are finding an increased application in agricultural lines. A recent catalog of the Independent Powder Co. is devoted largely to such uses of their products. Dynamite seems to be not only available, but highly efficient for such purposes as extracting stumps; breaking subsoils to assist drainage and the entrance of plant roots; digging post holes; ditching, especially for drainage purposes; blowing out holes for planting trees; breaking up unwieldly boulders, and excavating in connection with road work. Apparently, agriculture is destined to be a close second to the mining industry in its consumption of explosives.

Dr. Orin W. Joslin, formerly of Milwaukee, and now at Linden, Wis., assures us that we may have in the not far distant future, a process for separating all metals from the ores by the simple elements of common salt and water in the presence of electricity; that no matter how many metals are contained in the ore, they will all be separated at the same time and collected separately and that when collected they will be chemically pure, even including iron; that such a plant can be built on an individual property at a cost not to exceed $15,000 with a capacity of 100 tons per day; and that the cost for separating all of these metals together will range from 40c. to $1.75 per ton. The Dodgeville, Wis., *Chronicle* says it awaits with nervous anxiety some tests now being made "in Colorado in a locality where at least six different metals exist within a radius of four miles." Our nerves are calm. We have an advance seventh-son report on the result.

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This tale concerns a Mexican patriot who answered the call of duty and took to the hills with his followers for the purpose of saving the republic. An American surveying party unfortunately got into the same hills, and this party was short of transportation facilities; in fact, its sole transportation facilities consisted of a deep-sea-going mule, originally white in color. The surveyors saw the patriot before he saw them, and attempted to hide the mule behind a *maguey,* but the attempt was unsuccessful; an ambassador from the patriot presently appeared with the statement that the salvation of the republic depended on his obtaining the white mule and $400. The situation was unpleasant for the chief engineer. He could not get along without the mule, and $400 did not exist in that party. But inspiration came to him. He selected one of his assistants, a Vermont Yankee, and appointed him minister plenipotentiary to the patriot court. The Vermonter departed forthwith and within an hour returned—not alone, but with a horse. This shows that blood will tell.

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A correspondent has related to us the experience of J. J. Keating, of Tuolumne, Calif. The East Belt district in that region is a "faulty" proposition. Three mining companies had gone broke looking for the vein beyond the fault in the Iron Springs mine near Tuolumne. A new company engaged Mr. Keating to undertake the task, knowing him to be an excellent man on formation problems. Mr. Keating in three months ran over 500 ft. of drifts and crosscuts looking for the missing vein, but with no success. He had spent over $2000 and there was nothing in sight. About that time came along the JOURNAL of Mar. 22, 1913, containing an article on "Graphics Applied to Fault Problems," by E. R. Rice. Mr. Keating read and reread this article and the idea seeped into his mind that here was the key of the mystery that was baffling him. A day more of cogitating with the article and Mr. Keating sallied forth to make a new try. He drifted in an entirely new direction, picked up traces of the vein in 56½ ft. and at 113 ft. struck it. He said he believed in giving credit where credit was due and that Mr. Rice's article was precisely applicable to the problem he encountered. This is an exemplification of the value of reading technical literature.

Smuggler-Union and Liberty Bell Case

By R. W. Raymond

SYNOPSIS—Higher court upheld decision of lower court in case of Smuggler-Union vs. Liberty Bell. "Reckless" trespass is same as "wilfull" trespass. Trespasser must prove nonintention by preponderating evidence. Gross sum realized by trespasser is recoverable, without allowance for expenditures.

The decision of the U. S. Circuit Court of Appeals of the Eighth District (Colorado), filed Mar. 3, 1913, in the case of the Liberty Bell vs. the Smuggler-Union, is generally regarded as extremely important. But, after careful study of it, I am compelled to say that I think this general impression is due rather to the amount of money involved than to the novelty of any of the principles laid down by the court.

The plaintiff in error had been the defendant in the court below, and for convenience is called in this decision "the defendant" still. For still greater convenience, I venture in this summary to ignore both terms, and refer to the parties as L. B. and S. U.

S. U. brought an action against L. B. to recover damages for a wilful and intentional trespass upon its mining property. The verdict of the jury declared the trespass to have taken place as charged, and to have been wilful and intentional, and assessed the damages accordingly. As to the facts, this verdict, though rendered on conflicting evidence, was not likely to be reversed by a higher court on appeal, because it was not contrary to the evidence, but supported by that part of the evidence to which the jury, after hearing witnesses and arguments, chose, in its discretion, to give the greater weight. But the fact of trespass and the amount of ore removed by L. B. from S. U. ground were, perhaps, the only simple facts determined by the jury. As to the extremely important questions: Whether the trespass was wilful, and what should be the measure of damages decreed, the jury was guided by the instructions of the court; and it was chiefly as to instructions which the court either gave or refused to give to the jury, and as to its admission or exclusion of certain evidence, which might have affected the jury, that S. U. asked for a reversal of judgment.

Two Classes of Trespass Recognized

In order to understand the decision of the higher court, it should be remembered: (1) That every trespass, whether intentional or not, is a wrong for which the offender is liable in damages. (2) Such damages may be either actual or punitive. If the trespass be unintentional, the injury actually done may measure the damages exacted, though, even in such case, it is neither uncommon nor unreasonable to fix the damages at such a figure as will make the trespasser liable for the legal cost of the proceedings. If the trespass be wilful and intentional, what is called in this decision "higher damages" are exacted.

Intruder Must Take Precautions to Determine Possible Trespass

(1) One point strongly urged in the appeal of the L. B. was, that the trial judge, in charging the jury, had added the words "or reckless" to the words "wilful" and "intentional" in describing the kind of trespass deserving higher damages, thus intimating that if a trespasser could have found out whether or not he was intruding on another's property, but did not take pains to do so, his "recklessness" was practically wilfulness.

In pursuance of the same proposition, L. B. complained of the refusal of the court below to charge that it was not enough to prove wilful or intentional trespass that L. B. might have known, or might have been led to believe from facts in its possession, that it was trespassing. Or, as L. B. requested the court to charge:

> In other words, no honest mistake or negligent omission will justify a finding of wilfulness. There must have been a dishonest purpose to take the ore in spite of knowledge that it belonged to another, or a deliberate omission to avail itself of knowledge at hand, amounting to an intent to take what did not belong to it, to warrant such a finding.

This decision overrules this objection; and, on the record submitted, seems to be clearly right. I should add that the original action involved our ridiculous "law of the apex," and could not have arisen under any other law. L. B. took ore from under a claim owned by S. U. (at least, that is the situation on which the appeal as to this point is based), and claimed afterward that it did so in an honest belief that it was following an extralateral right of its own. Now the extralateral right, being an easement impairing the common-law ownership of land, must be clearly proved, in order to warrant what would otherwise be trespass. But everybody knows that it has been, since 1872, a general practice, in those United States states and territories which constitute the only region on earth cursed with such a law, to go ahead across boundary planes underground, taking pains not to know whatever might legally prevent such invasion. In the early days, the trespasser, having got away with his booty, was seldom pursued, after the owner had recovered the ground, with what was left in it. In later times, the recovery of damages, as well as the ejectment of the invader, has been more frequently attempted. But the spirit of "going ahead and taking the chances," inherited from an elder period, is still prevalent. I think it may fairly be ascribed to the U. S. statute, which gives to purchasers of mineral land in certain doomed localities no clear title, but only the basis for a fight. This decision, with force but not novelty, reiterates the old principle that the trespasser is wilful if he is reckless.

(2) A second claim made by L. B. was that the wilfulness of its trespass, if it existed at all, began only at a certain date, and could not, therefore, be applied in measuring damages for ore removed before that date. This point is decided against L. B., upon an analysis of the testimony, and requires no comment here, since it involves no new principle of general application.

Trepasser Presumed to Know What He Is Doing

(3) Error was assigned as to the charge of the court below that the burden of proof was upon L. B. to show that the trespass was not wilful or intentional, and also in its refusal to charge that after the introduction of evidence by a trespasser to show that his trespass was not wilful or intentional, the burden of proof rests upon the

owner, to rebut the trespasser's evidence by preponderant evidence. This proposition was properly overruled. To put the matter in a nutshell; the trespasser is legally presumed to have known what he was doing. If he or his witnesses say that he did not know, and his opponent says in reply nothing at all, the jury can still decide whether the legal presumption against him has been overcome by his denial. In support of its decision on this point, the court has cited many authorities, which are as conclusive as they are, to my mind, unnecessary.

(4) Still fighting the verdict of "wilfulness," L .B. alleges error in the refusal to charge that where extralateral rights exist, and the ore taken may, with reasonable probability, come from an apex on the taker's ground, and it is impossible or difficult and expensive to determine the exact facts before taking out the ore, then the taking was not wilful, unless by preponderance of evidence it is shown that the taker did in fact intend to take what was not his.

In denying this allegation of error, the court simply quotes, as a sufficient explanation to the jury of the extralateral rights of the parties, a passage from the charge of the court below, of which it says:

> It told them in plain words that while there was a presumption that all the ore within the side and end lines of the Waters claim belonged to S. U., yet, if the apex of a vein was outside the Waters claim and within L. B.'s claim, L. B. had a right to follow such vein and remove the ore therefrom, notwithstanding such vein should extend within the boundaries of the Waters claim, but that the burden of proof was upon L. B. to establish that the apex of the vein was within L. B.'s claim.

This reply to the assignment of error simply declares that the court below sufficiently declared the law, and properly left to the jury to determine whether, under the circumstances, the trespass of L. B. had been "wilful" or not. There is nothing particularly new or questionable in this position.

Objections to the Amount of Damages

The second important branch of the appeal of L. B. concerned the charge of the court below as to the "measure of damages" for wilful trespass.

(5) L. B. objected to the illustrations given to the jury of the rule of damages in cases of timber-cutting and coal-mining beyond boundaries, because in such cases there is no such uncertainty as the extralateral right in mining involves. This objection was justly overruled, as I understand the court's position, on the ground that the lamentable uncertainty of the extralateral right imposes upon the mine operator special care to avoid trespass (especially because the crossing of the vertical boundary planes determined by surface lines of ownership is *prima facie* trespass) and that this uncertainty, pleaded by an innocent trespasser, would have its due effect in mitigation of his offense before judge and jury; but that when a trespass has been declared to have been wilful, the "extralateral right" has nothing to do with the question of damages.

Higher Court Sustains Damages Based on Value of Ore on Surface

(6) L. B. objected to the charge to the jury in the court below, and the court's refusal to charge, under two heads: In case the trespass were held to be wilful; and in case it were regarded as unintentional. I may here disregard the latter allegations of error, since, if I am not mistaken, the jury found that the trespass was wilful, and subject, therefore, to the "higher damages." Under this head, the court below charged (and the Court of Appeals approves the declaration), that, if the trespass was wilful, etc., the trespasser is liable for the full amount realized by him from the conversion of the ores to his own use, regardless of the expenditures incurred.

L. B. contended that,

> In case of a wilful or an intentional trespass under such circumstances as to show an intentional taking of the property of another, ... in which case the damages are punitive, the measure being the value of the ore, not unbroken in the mine, but at the mouth of the pit or shaft or tunnel, without allowance to the trespasser for the cost incurred in mining and getting it to that point—in other words, the value which the ore might have had, unbroken in the mine, to the owner or trespasser is enhanced by the cost of mining and raising it, at the cost of the trespasser and for the benefit of the owner.

In confirming the refusal of the court below to give this instruction as to the higher measure of damages, this decision lays down the English rule, which has been followed in all the federal courts, that no allowance whatever will be made as to the acts or expenditures of a wilful trespasser. This rule is fortified by the citation of a large number of cases, and undoubtedly warrants the instruction given by the trial judge, that if the trespass was wilful, S. U. is entitled to recover from L. B. the full amount realized by the latter from the conversion of the ores to its own use, regardless of the expenditures incurred by it in so doing.

But several of the cases cited go much further. Thus it is held that in case of an intentional trespass the owner may pursue and reclaim the property wherever he can find and identify it. And according to such decisions as that of United States vs. Waters-Pierce Oil Co. (196 Fed. 767) the owner can recover from a third party the value of a manufactured article made from his property. In that case, the trespasser had taken crude gum, sold it to a distiller, who had distilled and rectified it, and sold the resulting turpentine and resin to the Waters-Pierce company, which was held liable to the U. S. for the full value of the manufactured product. There are similar decisions concerning timber unlawfully taken and converted into fence-posts, etc. The instructions in the case before us went no further than the recovery of the gross sum actually realized by the trespasser, L. B., itself.

Evidence as to Low Grade of Ore Not Recognized

An interesting point was raised by the refusal of the trial court to admit statements from the annual reports of L. B., showing the average value per ton of all ore taken from the mine before, during and after the trespass. These statements were offered to show that, during the trespass, the average value of all ore mined was lower than before or after the trespass, and therefore that the ore taken from S. U. must have been of inferior grade. The trial judge refused to admit this evidence because it could have no effect unless accompanied by evidence as to the value of each body of ore mined during the corresponding periods from the L. B. vein alone, and this would involve a collateral inquiry on a new subject.

The full record of the case below is not before me; but the point thus raised indicates a situation not uncommon in cases of lode-mining trespass, whether intentional or not. An innocent trespasser, honestly believing himself to be within his own ground, would see no reason for

keeping a separate account of the yield, cost and profit from one particular stope, the product of which would go into the general product of the mine. A "reckless" trespasser, that is, one who took the chances, and did not trouble himself to ascertain the facts, would be still less likely to keep such special accounts as would indicate afterward that he had not been wholly innocent in his professed ignorance; and a wilful trespasser would be least likely of all to show in that way that he had been preparing to fight a suit for damages. The consequence is, that when trespass has been proved, there is usually no exact evidence as to the amount and value of the ore unlawfully taken; and, in accordance with a well known principle (the trespasser being the only party that has had such evidence, and having destroyed, suppressed, neglected to preserve, or failed to produce it), whatever evidence is produced is construed with special severity against the trespasser. Thus, excavations filled with waste, occurring on the dip of a vein otherwise proved to exist, have been held to prove the continuity of the vein, though it could no longer be traced through them; and old stopes, similarly filled, have been adjudged, in estimating damages, to have been originally filled with valuable ore, in the absence of proof to the contrary. In estimating the value, as well as the tonnage, of ore taken by a trespasser, a similar rule obtains. I have known the value of such ore to be estimated upon sample assays from the remnant of the orebody; or upon oral testimony; or upon average mill returns; but whatever the available evidence may be, it is always construed with a presumption, so to speak, against the trespasser, who alone at the time knew the facts, and who, for any reason, has failed to produce them.

Evidence of Low Grade Possibly Admissible Earlier

In this case, judging, as I have said, without the opportunity to study the record of the trial below, I infer that the jury assessed the damages for a wilful trespass on the basis of evidence by measurement of the tonnage unlawfully removed, and of evidence by assays of the gross value thereof. The exclusion by the trial judge of evidence offered by L. B. to show a probability that the ore taken was of low grade seems to have been justifiable, under the circumstances, and for the reasons given. If the usefulness of such evidence had been foreseen, and due notice of intent to produce it had been given in the pleadings, the inquiry which it involved, though collateral, might have been admissible. This I understand the trial judge to have intimated, while he refused to admit this new collateral issue as a mere basis of argument for mitigation of damages by a trespasser subject to the general rule of evidence above stated.

Summary of Court's Decision

It is unnecessary to review in detail other parts of this decision, which turn upon questions peculiar to the record of the case. In summary, it states the following propositions of general importance:

(1) A "reckless" trespass is, for the assessment of damages, the same as a "wilful" or "intentional" one.

(2) The question whether a proved trespass was wilful, intentional, reckless, or honestly unintentional, is for the jury to decide. (In this case, there was conflicting evidence, and the court says that it would not have overruled the jury if it had declared the trespass unintentional; nor will it question the jury's verdict to the contrary.)

(3) In determining this question, the trespass being proved, the burden of proof is upon the trespasser throughout, to overcome by preponderating evidence the legal presumption that the trespass was intentional.

(4) In cases of mining trespass, the uncertainty of title due to the extralateral right does not place the trespasser in any different category from that of a trespasser upon timber lands or coal lands, to the ownership of which no extralateral right is attached. In all cases, the surface boundaries of a tract are *prima facie* proofs of its ownership; and the crossing of such boundaries in mining underground constitutes a trespass, unless warranted by an extralateral right. It is, therefore, the duty of a miner, before committing such a *prima facie* trespass, to use all reasonable and practicable means to assure himself of his extralateral right. Failure to do this may be interpreted by a jury, considering the evidence according to this rule, as proof that his crossing of such boundaries, if afterward shown to be a trespass, was "reckless," and is punishable by punitive damages, as if "intentional.'

(5) In determining damages for intentional trespass, the owner is entitled to recover from the trespasser the gross sum realized by the latter, without any deductions whatever for expenses. In this respect, there is no distinction between underground trespass in mining and trespass on the surface.

This decision comprises other points, which seem to depend upon the record of the particular case, or the form of the "assignments of error" on appeal, and, therefore, to have no special interest, except to members of the bar.

Decision Involves Nothing New but Exemplifies Iniquity of Apex Law

In conclusion, I can only say that I think it contains nothing new, and nothing unsound, as an interpretation of the law. Whatever hardship to L. B. it may involve, seems to be chargeable to the findings of fact by the jury of the trial court. That jury may have been wrong in finding that the admitted trespass of L. B. on S. U. was to such a degree intentional as to warrant "higher damages." But, that fact having been once established by a jury verdict, the rest follows.

To my mind, this decision of the Circuit Court of Appeals constitutes a new argument against the "law of the apex." This great lawsuit, with its immense legal expense and its immense assessment of damages against the defeated party, could never have occurred under the laws which govern mining titles in the majority of the states, and throughout the rest of the world. The extralateral right, which characterizes mining titles granted by the United States on certain public lands, has been often defended, as an encouragement to mining enterprise. This case is a sharp warning that it is treacherous and dangerous as well.

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The Price of Steel Is Based f.o.b. Pitsburgh, this having been the custom for 50 years. The Pittsburgh base, plus the freight to different localities, makes the prices at those points. Base price for foundry pig iron is f.o.b. Birmingham, except in the Central West, where the base price is f.o.b. Mahoning or Shenango Valley furnace; base for charcoal iron f.o.b. Michigan furnaces. The Pittsburgh base price is not adhered to as much now as formerly, as large steel centers are springing up in other localities. In other words, Chicago, Buffalo and the East make their own prices now. Colorado Fuel & Iron Co. sells its product on a Pueblo, Colo., basis.

PERSONALS

J. B. Farish is in New York.

Franklin Guiterman has gone to Denver.

John L. Malm has gone to Montana on professional business.

J. B. Ross, of Denver, Colo., is in New York for several weeks.

George W. Schneider is inspecting mines in Clear Creek County, Colorado.

G. M. Colvocoresses has been spending some time in the Sudbury district in Ontario.

W. M. Brewer has been examining mining properties in the Coast district of British Columbia.

John U. Higinbotham has been appointed assistant treasurer of the Detroit Lubricator Co., Detroit, Mich.

E. W. Lawler has resumed the position with the Abbé Engineering Co., New York, which he held several years ago.

G. W. Boyce has returned to New York from a trip to Aspen, Colo., and Terrazas, Mexico. The greater part of the trip was made by automobile.

W. J. Watson, manager of the Tyee Copper Co., in British Columbia, is in London to discuss with the directors the future operations of the company.

Rush T. Sill, of the firm of Sill & Sill, Los Angeles, Calif., has just returned from the Chloride district, Arizona, where he has been examining mines.

Dr. Theo. Goldschmidt, of Essen, Germany, is studying metallurgical processes in this country and has been spending some time at the Utah plants.

A. B. Willmott, of Toronto, has accepted an important consulting position with the Lake Superior Corporation. He will still maintain his office in Toronto.

Charles A. Banks, manager for the Jewel Syndicate, has returned to the Jewel mine, in the Boundary district of British Columbia, from a visit to England.

Carlos D. Cisneros, well known for his work in connection with the Lima Geographical Society, has been made a fellow of the Royal Geographical Society of London.

Chester G. Gilbert has been appointed to the position of curator of Mineral Technology in the United States National Museum. This is a new position in the museum.

A. A. Hassan has completed an examination of the Boston & Goldenville Gold Mining Co.'s property and will soon leave New York on his way to Alaska to examine a gold mine.

C. H. Benedict, metallurgical engineer for the Calumet & Hecla Mining Co., is at Anaconda, Mont., where a test of some 500 tons of the Calumet & Hecla tailings is being made by the Peck concentrator method.

C. B. Burchell, formerly manager of the Maritime Coal, Heat & Power Co., Nova Scotia, has accepted a special commission to make professional examinations in Europe. He will be absent for six months.

W. L. Watts, of Los Angeles, recently spent two weeks in Mono County, Calif., on professional business. Mr. Watts is an expert petroleum engineer, and author of valuable State Mining Bureau publications on the subject.

H. C. Hoover arrived in New York last week from California, where he has been giving his attention to the affairs of Stanford University, of which he is a trustee, and proceeded to London this week. He expects to return to America this fall.

Richard Marsh, some years ago connected with mining in Rossland, B. C., and since then at Spokane and Republic, Wash., has been appointed superintendent of the Yankee Girl gold mine, at Ymir, B. C., in place of Ivan DeLashmutt, who is now manager for the Standard Silver-Lead Mining Co., at Silverton.

OBITUARY

Mark H. Cobb died in Philadelphia, June 8, aged 85 years. Born and brought up in Connecticut, he was engaged in newspaper work for several years in Pennsylvania and Washington. Later he was for over 40 years an officer in the United States Mint at Philadelphia, holding various positions under different directors. His last office was registrar, which he held for 15 years.

SOCIETIES

Missouri School of Mines—The annual commencement was held at Rolla, Mo., May 30, when 23 men were graduated.

South Dakota School of Mines—The annual commencement exercises were held at Rapid City, June 1-4, five men receiving degrees in mining and metallurgy.

Bureau of Mines—The offices of the Bureau have been removed to new quarters at 710 E Street, Northwest, Washington.

American Institute of Chemical Engineers—The sixth semi-annual meeting will be held at Boston, June 25-28. An excellent list of papers is promised, and there will be visits to many points of interest in and about Boston.

American Institute of Mining Engineers—At a meeting of the board of directors of the Institute, on May 23, the request was granted for the establishment of the Denver local section, the territory to be covered being the state of Colorado. David W. Brunton is chairman of the Denver local section.

Mining and Metallurgical Society—Following the announcement of the favorable vote by the members of the Mining and Metallurgical Society of America on the proposed plan of affiliation with the American Institute of Mining Engineers, the members of these two societies residing in or near San Francisco, held a joint dinner on May 23, at the Hotel Bellevue, San Francisco. H. C. Hoover presided and J. A. Holmes was present as guest of honor. Addresses were made by Dr. Holmes, F. W. Bradley, H. Foster Bain, S. B. Christy and others.

Special Libraries Association—The fifth annual meeting of the association will be held at the Hotel Kaaterskill, Catskill Mountains, New York, June 24 to 26. There will be three meetings upon (1) the relations between general and special libraries; (2) the handling of clippings and training of special librarians and (3) special library organization, etc., at which addresses and papers will be given by Dr. W. Dawson Johnston, Wm. Barclay Parsons, Dr. Frederick L. Hoffman, Hon. Robert E. Luce, Dr. J. Franklin Crowell and others. The secretary is Guy E. Marion, 93 Broad St., Boston.

Missouri School of Mines—The Junior class will spend three weeks in Colorado beginning June 4. This is a required part of the curriculum. The class will visit Colorado Springs, Colorado City, Pueblo, the Cripple Creek district, Leadville, Breckenridge, Valdoro, Montezuma, Waldorf, Silver Plume, Georgetown and Idaho Springs. The class will be accompanied by Professors G. H. Cox, H. T. Mann and C. R. Forbes. The Sophomore class will do field work in mine surveying at Edwardsville, Ill., during the first two weeks in June. This work will be in charge of Professor C. R. Forbes and E. S. McCandliss.

INDUSTRIAL NEWS

The Orenstein-Arthur Koppel Co., Koppel, Penn., has given its agency for Canadian business to the Canadian Fairbanks-Morse Co., Ltd., having offices at Montreal, St. John, Ottawa, Toronto, Winnipeg, Saskatoon, Calgary, Vancouver and Victoria. The Canadian Fairbanks-Morse Co. is one of the largest concerns for manufacturing and trading in all kinds of machinery.

H. L. Watson, member American Society of Mechanical Engineers, formerly sales engineer with the Allis-Chalmers Manufacturing Co., of Milwaukee, has accepted the position of sales manager for the DeLaval Steam Turbine Co., of Trenton, N. J., manufacturer of steam turbines of the single-stage, velocity-stage and pressure-stage type, also of centrifugal pumps, speed-reduction gears, turbine blowers and other apparatus of an allied nature.

The Gardner-Rix compressor is described in a publication of the Gardner Governor Co., of Quincy, Ill. The machine is a small, vertical, high-speed, power-driven compressor with automatic lubrication and a thin light valve which permits rapid operation. The piston is of the trunk pattern. The machines come in two-cylinder and single-cylinder designs and are adapted for motor drive through belts, gears and silent chains. The capacities range from 8 to 140 cu.ft. of free air per min., pressures from 40 to 250 lb. per sq.in. and revolutions per minute from 400 to 600. The machine

seems to be exceedingly compact and will require small floor space.

The General Electric Co., Schenectady, N. Y., has received orders for equipment as follows: Silver King Coalition Mines Co., Park City, Utah, one 240-kv.-a. motor-generator set with 14-kw. exciter, to drive a 200-hp. motor for operating an electrict hoist; American Zinc Co., Mascot, Tenn., two 25-kv.-a. motors, one 200-kw. generator, two 1200-kw. generators, nine motors ranging from 20 to 150 hp. and switchboard apparatus; Buckhorn Mines Co., at Beouawe and Palisade, Nev., two 345-kv.-a. generators with 35-kw. exciters, one 10-kv.-a., two 25-kv.-a. and eight 219-kv.-a. transformers and switchboard apparatus in the power plant and 24 motors ranging from 10 to 100 hp. for operating mining machinery; Penobscot Mining Co., Helena, Mont., five motors ranging from 10 to 25 hp., one 10-kv.-a. and three 50-kv.-a. transformers and switchboard; Oliver Iron Mining Co. for its mines at Ironwood, Mich., one 300-hp. motor, six 5-kv.-a. and six 10-kv.-a. transformers and switchboard material.

Tate-Jones & Co., Inc., Pittsburgh, Penn., has issued a pamphlet in which is discussed the comparative cost of burning fuel oil, producer gas, natural gas and powdered coal in furnace work. The cost of fuel, cost of plant, floor space, interest on investment, taxes, depreciation and repairs, labor, power needed for auxiliaries, cost of water and reliability are all considered in making the comparisons.

TRADE CATALOGS

Abendroth & Root Manufacturing Co., Newburgh, N. Y. Catalog. Motor trucks. Illustrated, 6x9 inches.

The Watt Mining Car Wheel Co., Barnesville, Ohio. Catalog "B." Steel ore cars. Illustrated, 20 pp., 5½x8 in.

The C. O. Bartlett & Snow Co., Cleveland, Ohio. Bulletin No. 40. Garbage-disposal machinery. Illustrated, 20 pages, 6x9 in.

In a booklet issued by the Southern Railway Co., Washington, D. C., the mineral resources of the southeastern states are described, and some of the mining operations illustrated.

The Mine & Smelter Supply Co., 42 Broadway, New York. Catalog No. 26. Electrical, telephone, mine and street railway supplies and apparatus. Illustrated, 672 pages, 7x10 in.

The Dodge Manufacturing Co., Mishawaka, Ind. "Over the Seas," a pamphlet emphasizing the Dodge system of packing for over-the-seas shipments of power-transmission machinery in special boxes and cases. Illustrated, 6pp., 6x4 inches.

The Denver Fire Clay Co., Denver, Colo. Bulletin describing and illustrating the Case low-pressure oil forge for heating drill steel. The drills are under observation at all times. The furnace is practically noiseless and smokeless in operation.

A recent catalog of the Independent Powder Co., of Joplin, Mo., describes methods of manufacture of the products of the company, and enumerates the powders offered for blasting purposes. Besides, the ordinary straight dynamite, gelatin and ammonia powders, slow-freezing powders, blasting gelatin, etc., an explosive called "Miners' Special" is noted, which is a particularly bulky dynamite, offering the advantage of permitting the miner to fill his hole with explosive without greatly increasing the expense. It is equivalent to 45% dynamite; is said to be fumeless and to burn with difficulty. Tamping already prepared, in boxes similar to dynamite boxes, is also described.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are suplied at 40c. each.

CUPOLA FURNACE. William Newton Best, New York, N. Y. (U. S. No. 1,061,158; May 6, 1913.)

JIG. Harry Preston Altman, Collinsville, Ill. (U. S. No. 1,061,581; May 13, 1913.)

ELECTRIC FURNACES—Regulating Electric Furnaces. P. L. T. Héroult, La Praz, Savoie, France, assignor to Société Electro-Metallurgique Francaise, Froges, France. (U. S. No. 1,061,612; May 13, 1913.)

ORE SEPARATOR (Dry). George W. Fisher, Tacoma, Wash., assignor of one-third to Ernest H. Tucker and one-third to Charles W. Wackershauser, Tacoma, Wash. (U. S. No. 1.061,830; May 13, 1913.)

BLAST FURNACES — Improvements Relating to Blast Furnaces for the Smelting of Iron and Other Ores. T. B. Rogerson, Glasgow, Scotland. (Brit. No. 10,399 of 1912.)

SILICON—Process of Making Alloys. Robert A. Hadfield, Sheffield, England. (U. S. No. 1,061,373; May 13, 1913.)

LADLE RUNNER. Edward L. Ford, Youngstown, Ohio. (U. S. No. 1,061,280; May 13, 1913.)

POT FOR HOT METAL, ETC. Erwin C. Sherman, Youngstown, Ohio. (U. S. No. 1,061,784; May 13, 1913.)

TUNNEL FURNACE. Arthur Ramén, Olympia, Sweden. (U. S. No. 1,062,606; May 27, 1913.)

SODIUM—Improvements in the Manufacture of Sodium Alloys. British Cyanides Co., Ltd. and E. C. Rossiter, London, Eng. (Brit. No. 14,254 of 1912).

ZINC—Improved Apparatus for Use in Connection with the Extraction of Zinc. W. D. Jones, Swansea, Eng. (Brit. No. 15,888 of 1912.)

ZINC-LEAD ORE TREATMENT—Process for the Treatment of Refractory Complex Zinc-Lead Ores. A. G. French, Nelson, B. C. (Brit. No. 22,077 of 1912.)

FELDSPAR—Process of Making Potash Alum from Feldspar. Edward Hart, Easton, Penn. (U. S. No. 1,062,278; May 20, 1913.)

BELT CONVEYOR—Joseph Dierdorff, Columbus, Ohio, assignor to the Jeffrey Manufacturing Co. (U. S. No. 1,062,325; May 20, 1913.)

CHARGE-RECEIVING TRUCK (Underground). Soren C. Monberg, Leadville, Colo. (U. S. No. 1,062,492; May 20, 1913.)

DRILLING—Improvements in or Connected with Supporting Frames for Apparatus for Boring Holes in Mines. E. Meyer, Remscheid, Germany. (Brit. No. 25,835 of 1912.)

DRILLS—Chuck for Rock Drills. Charles A. Hultquist, Los Angeles, Calif. (U. S. No. 1,062,651; May 27, 1913.)

MINE CAGES—Safety Appliance for Mine Cages. Gustave E. Huttelmaier, Scottdale, Penn. (U. S. No. 1,061,747; May 13, 1913.

MINE-CAR WHEEL. Franklin C. Hockensmith, Pittsburgh, Penn., assignor to Hockensmith Wheel & Mine Car Co., Penn Station, Penn. (U. S. No. 1,061,746; May 13, 1913.)

MINER'S LAMP. William P. Rice, Regina, Ky. (U. S. No. 1,062,504; May 20, 1913.)

SURVEYING—Transit. David W. Brunton, Denver, Colo. (U. S. No. 1,062,582; May 27, 1913.)

CRUSHER. Bruce W. Traylor, Allentown, Penn., assignor to Traylor Engineering & Manufacturing Co. (U. S. No. 1,062,520; May 20, 1913.)

CRUSHING—Grinding Mill. George Lane, Poughkeepsie, N. Y., assignor to Lane Brothers Co. (U. S. No. 1,062,481; May 20, 1913.)

FLOTATION PROCESS—Process for Treating Sulphide or Carbonate-Sulphide Ore Slimes and Ores by Flotation. K. Schick, Siegen, Germany. (Brit. No. 25,689 of 1912.)

MAGNETIC SEPARATION—Separation of Substances by the Wet Magnetic Process. Georg Ullrich, Magdeburg, Germany, assignor to Fried, Krupp Aktiengesellschaft Grusonwerk, Magdeburg, Germany. (U. S. No. 1,062,522; May 20, 1913.)

ALLOY OF MANGANESE, TITANIUM AND SILICON. Frederick M. Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Co., New York, N. Y. (U. S. No. 1,062,430; May 20, 1913.)

PYRITE SMELTING—Metallurgical Apparatus. William Bryant, Massillon, Ohio. (U. S. No. 1,061,446; May 13, 1913.)

REFINING FURNACE. David Wesley Blair, New York, N. Y., assignor, by mesne assignments, to Metallurgical Research Co., New York, N. Y. (U. S. No. 1,061,964; May 13, 1913.)

SMELTER SMOKE—Process of Obtaining Sulphur from Smelter Gases. Hamilton Sanborn, Henry Grattan McMahon, and John Trumbull Overbury, San Francisco, and Stewart Woodford Young, Palo Alto, Calif., assignors, by direct and mesne assignments, to The Thiogen Co., San Francisco, Calif. (U. S. No. 1,062,120; May 20, 1913.)

BLAST-FURNACE SMELTING — Method of Obtaining Values from Copper-Bearing Material. Howard F. Wierum, Upper Montclair, N. J. (U. S. No. 1,063,486; June 3, 1913.)

CYANIDING—Process of Precipitating and Recovering Materials from Solutions. Charles W. Merrill, Berkeley, Calif. (U. S. No. 1,063,567; June 3, 1913.)

CYANIDING—Process of Precipitation of Material from Cyanide Solutions. Charles W. Merrill, Berkeley, Calif. (U. S. No. 1,063,568 and 1,063,569; June 3, 1913.)

DREDGE HOPPER. John Reid, New York, N. Y. (U. S. No. 1,063,284; June 3, 1913.)

SLIMES TREATMENT—Improvements in and Relating to Processes and Apparatus for Separating Slimes from Sand. P. Argall, Denver, Colo. (Brit. No. 24,009 of 1912.)

FERRO ALLOYS—Process of Producing Low-Carbon Ferro-Alloys. John M. Morehead, Chicago, Ill., assignor to Electro Metallurgical Co., Chicago, Ill. (U. S. No. 1,063,280; June 3, 1913.)

SILICON—Process of Producing Elementary Silicon and By-Products. Florentine J. Machalske, Philadelphia, Penn., assignor of one-half to Christopher Offenhauser, Philadelphia, Penn. (U. S. No. 1,062,982; May 27, 1913.)

DRILL—Rock-Drill Tester. William D. Paynter, Grass Valley, Calif. (U. S. No. 1,062,662; May 27, 1913.)

DRILLING-MACHINE—Charles B. Richards and William H. Jenkins, Cleveland, Ohio, assignors, by mesne assignments, to Cleveland Rock Drill Co., Cleveland, Ohio. (U. S. No. 1,063,598; June 3, 1913.)

DRILLS—Engine for Rock-Drills. George H. Gilman, Claremont, N. H., assignor to Sullivan Machinery Co., Claremont, N. H. (U. S. No. 1,063,194; June 3, 1913.)

DUMP CAR. Thomas R. McKnight, Aurora, Ill., assignor to Western Wheeled Scraper Co., Aurora, Ill. (U. S. No. 1,063,276; June 3, 1913.)

FLUME GATE—Wilson P. Harlan, Brawley, Calif. (U. S. No. 1,063,438; June 3, 1913.)

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—June 4

A Cut in Oil Prices has been made by the Standard Oil Co. at the well at Whittier in Los Angeles County and in all the fields in Orange County. This is the first cut it has made since the company recommenced business in these fields. The new schedule is as follows: 18 to 21.9 gravity, 60c.; 22 to 24.9 gravity, 65c.; 25 to 27.9 gravity, 75c.; 28 gravity and over, 85c. The Standard buys practically all the oil from these fields except that contracted to the Amalgamated and the Union, which companies also operate wells in these fields. The principal companies selling to the Standard are the Petroleum, the Dorsby, Walker-Brand, Birch, Brea Cañon, Fullerton, and Murphy. There is no reason given for the reduction.

The Recent Mining Congress attended by the miners and mine owners of southern Oregon and northern California held at Redding, demonstrated the necessity for closer attention to mining interests and less devotion to the carnival spirit. The people of Redding, anxious to draw a large number of visitors from the mining and other towns, prepared for a week of jollity and came near spoiling the congress for practical work. A street carnival was inaugurated and greater attention seemed to be given by the visitors to the enjoyment of the occasion than to the serious business of the congress. Some of the more influential men in the organization saved it from complete collapse and the ultimate result was that resolutions were adopted to correct such tendencies in the future. The visits made by the delegates to the Mammoth smelting plant and the Heroult iron furnace, and to the farming districts which were reported to be damaged by blast-furnace fumes, gave to the delegates valuable object lessons and proved to them that instead of being injured by the operation of the furnaces the farming industry has been benefited and developed to great magnitude because by the establishment of smelting operations in the county a large number of quartz mines have been developed in the near vicinity that otherwise would have remained undeveloped for several years, and this expansion of industry directly benefited the farmers. Farmers themselves now realize that their continued agitation against the smelter would in time prove disastrous to themselves. The next meeting of the congress will be held at Ashland, Ore., the time of the meeting to be agreed upon later. The following are the names of the officers elected for the ensuing year: I. J. Luce, Etna Mills, president; L. L. Ray, Medford, Ore., first vice-president; W. H. Roberts, Redding, second vice-president; W. D. Egilbert, Redding, secretary; John E. Bashburg, treasurer.

Resolutions Adopted by the Mining Congress at Redding embraced several important and vital questions affecting the mining industry, besides declaring that the smelting of copper ores is doing no damage to crops. The prompt reestablishment of the Redding land office was recommended on the ground that the removal of this office imposes great hardships on the most important public land and mineral district in California. An increased appropriation for maintaining the state mining bureau was recommended. The congress urged the placing of railroad land grants on the market at a price not in excess of that asked by the United States Government for similar lands. The congress held that much of the difficulty in obtaining patents to mineral lands, even in well known districts which had not been proved for prospecting and development, is due or attributed to the encroachment upon the authority of the Department of the Interior by other departments and bureaus, notably the Forest Reserve. The elimination of all conflicting authorities in passing upon application for patent for mineral lands was recommended. It was also recommended that the state highway commission order a survey and report on the state highway from Redding to Oregon on the route of the old Oregon stage road, to connect with the Oregon state highway, in order to ascertain if this route is not the most practical and feasible route. This recommendation was made on the ground that Trinity, western Shasta and western Siskiyou Counties comprise a great gold district which has no adequate means of transportation. In order to encourage and assist in the construction of the proposed Humboldt & Eastern R.R. from Humboldt Bay through Humboldt and Trinity Counties to the Sacramento Valley, the congress recommended that the Forest Reserve expedite the opening of the Trinity forest reserve through which a considerable part of the railroad survey extends. The district through which the railroad would pass contains both mineral and timber of great value, the development of which will be encouraged and directly aided by adequate transportation.

BUTTE—June 4

Three Forks to Radersburg R.R. has been financed and funds will be forthcoming for the construction of the railroad from Three Forks to Radersburg, with the provision of extending it on to Helena by way of Townsend later on. Work was begun on the road more than a year ago, but financial difficulties arose causing suspension of operations after a portion of the road had been graded and steel laid for a short distance. About $25,000 has been paid in settling old bills. With the completion of this line many properties now operating in a small way, and making shipments by wagon will greatly increase their output, and others will open up which hitherto have not been profitably operated, due to the high cost of shipping ore by wagon.

DENVER—June 6

The Argentine Central Ry. now connecting the mines and mills of Georgetown and Silver Plume with those of the Waldorf company and others on Mount McClellan in Clear Creek County, is to be acquired by the Georgetown & Grays Peak Railway Co., capitalized at $100,000, articles of incorporation for which have just been filed by William Barth and others, of Denver.

Dr. J. A. Holmes, director of the Bureau of Mines, spent two days in Denver recently in the interests of low-grade ore-treatment experiments. It is understood that he has assigned two of the Bureau's men to devote the summer to ore-treatment work in Colorado. J. T. Singewald, Jr., is now in Silverton investigating conditions that he may report upon the advisability of establishing an experimental ore-testing station at that place.

Production of Cripple Creek for May amounted to 80,394 tons of ore, from which $1,207,752 was recovered. The tonnage and gross value was made up as follows: Golden Cycle, 33,000 tons, $660,000; smelters, 3800 tons, $247,000; Portland, 10,000, $202,000; Portland (Cripple Creek) 14,218, $46,919; Stratton's Independence 10,326 tons, $24,472; Ajax, 3400 tons, $11,560; Gaylord, 200 tons, $6500; Joe Dandy, 1650 tons, $3600; Wild Horse, 1400 tons, $4500; Isabella, 500 tons, $1000.

European Interest in Colorado Coal is evidenced by the pending deal involving the sale of 30,000 acres of coal lands in Routt County on the line of the Denver & Salt Lake Railroad, to French and Belgian interests. This deal is in a fair way to be consummated, the engineers having sailed from Antwerp to make the examinations. The Colorado representative of the Europeans is A. R. Bickerstaff of the Consolidated Securities Co., of Toronto, Canada, now in Denver, and Benjamin L. Dorsey, president of the Yampa Fuel & Iron Co. A bond issue of $28,000,000 has been arranged with the Paris bankers, and the contract is in the bank and the closing of the deal depends only on the verifications of the representations made. The reports on the quality and extent of the coal and on which the purchase was entertained, are those of Fenniman and Gale of the U. S. Geological Survey, W. Weston, and Paul Blount. The enterprise includes the building of a railroad from Hayden in the center of the bituminous coal regions, northward through the anthracite area of Pilot Knob, and thence to Casper on the Chicago & Northwestern R.R. crossing the Union Pacific at Walcott, and thus reaching a western, northwestern and northeastern market in addition to the Denver market reached by the Denver & Salt Lake R.R. from Hayden.

The Snow has Gone at Platoro, according to F. A. Wadleigh and George L. Beam, of the passenger department of the Denver & Rio Grande R.R. who returned to Denver recently after a four-days' tour of the new Platoro-Gilmore-Stunner-Jasper mining district in southern Colorado. They report the snow on the mountains all gone except in some deep gulches on the north side in the highest altitudes, and

prospectors, who have been waiting for the snow to disappear, are now covering the hills equipped for a season's work. All of the camps in the new district were excited over the "grass-root" strike made Sunday, June 1, on the "1876" claim of Cole, Hook & Co., not far from the property of the August Mining Co., which latter was located late last autumn by George Gilmore and which revived the district into prominence. The first assay, made June 4, of ore taken from the "1876" claim within one foot of the surface returned 4.14 oz. gold and 18.46 oz. silver, with a total value of $99.80. The town of Platoro is growing rapidly. It is on the south bank of the Conejos River, and has an abundance of water. A census taken May 31 showed a population of 400, as compared with five or six last winter. On that date 36 cabins and 67 tents were counted, with many new buildings and tents going up. There is a steady stream of people going into the district, and now that the snow has disappeared indications point to a great influx. The gold field is from 40 to 50 miles from a railroad, but there are automobile and stage lines from numerous San Luis valley railroad towns and good accommodations can be obtained at all the camps. At present Platoro is the only camp having a post office but the Post Office Department has arranged to establish offices at Stunner and Jasper which will be opened by July 1. It so happens that the telephone company has a trunk line through the district and soon the camps will be with telephone communication with the outside world.

DULUTH—June 6

Lake Shipments for May showed a gain as compared with the same month in 1912. Duluth showed the largest gain and Escanaba the smallest. A total of 7,284,212 gross tons was shipped by the six ports from which iron ore is forwarded, indicating a gain of 1,365,138 tons for this May as against May, 1912. Total shipments to June 1 this year have been 8,150,599 gross tons as against 6,123,116 tons for the corresponding period one year ago. The gain for the present season to June 1 was 2,027,483 tons. Indications at this time are that shipments for 1913 will considerably exceed the estimated 50,000,000 tons. The Lake Superior iron-ore shipments last year were 48,211,778 gross tons. The operators of the Mesabi range complain of a shortage of labor, although good wages prevail.

On the Cuyuna Range John T. Jones, of Iron Mountain, Mich., has just taken over what is known locally as the Harker property, and has procured options on several other proved properties. He is now in the East, and it is said that he represents J. M. Longyear, formerly of Marquette, and now a resident of Boston. The Harker property contains manganiferous ore. Mr. Jones has an option on a 45c. royalty basis on the Duluth-Moctezuma property on the Cuyuna, and also on the Congdon & Adams property. Mr. Jones is the step-furnace man, and it is reported that he is going to build a large furnace on the Cuyuna for the treatment of manganiferous and possibly other ores. The Cuyuna-Mille Lacs mine on the Cuyuna range is shipping manganese ore to the Bethlehem Steel Co. The operators of the mine say that they have more orders than they can fill. New pumps are being installed which will enable the company to produce from the 225 level. All ore at present is coming from the 125 level. It is just announced that a traction company is going to build a trolley system to connect Brainerd with all of the more important North Cuyuna range towns, including Crosby, Ironton and Cuyuna. The line will be 25 miles in length. It is stated that it is costing the Tod-Stambaugh company but 8c. per yd. to strip the Pennington mine, on the Cuyuna. The overburden on that range is mainly sand, and altogether the stripping conditions there are ideal.

TORONTO—June 7

Canadian Graphite, states Harrison Watson, Canadian trade commissioner to London, in reporting to the Department of Trade and Commerce as to the market for graphite, concerning which Canadian producers have been making inquiries, is not yet regularly established in trade with Great Britain. The view held by dealers is that while the Canadian variety differs from the Ceylon plumbago in many respects, and is only suitable for certain purposes, yet with the adoption of proper methods much more of it could find a market in England. Complaints are made, however, that such shipments as have been made are not of uniform quality, a consignment of satisfactory character being sometimes followed by shipments of a totally different and inferior grade. This has resulted in giving the Canadian article a bad name in the English market and placed shippers at a disadvantage in competition with the plumbago industry of Ceylon, which is perfectly and satisfactorily organized.

COBALT—June 7

Kalil Farah was Acquitted at the trial closed before Judge Leask at North Bay, June 6. The charge was brought by Count Guy de Forez of France who alleged that false and fraudulent representations had been made by the defendant in issuing the prospectus of the Big Pete Canadian Mines, Ltd., in February, 1908. The plaintiff alleged misrepresentation under 21 separate paragraphs in the prospectus. The judge decided that the prospectus had not been issued by Farah for the purpose of inducing people to subscribe for stock and in addition, the plaintiff failed to prove the allegations made with respect to the several statements contained in the prospectus which were stated to be falsely and fraudulently issued.

PORCUPINE—June 6

Damages Have Been Awarded to Burr E. Cartwright, president of the Temiskaming Mining Co., of Cobalt, and the Pearl Lake mines of Porcupine, amounting to $15,000 on a suit for libel against F. R. Jones & Co., New York. The charge was made in connection with statements by the defendants in a market letter issued in November of last year. In this letter, Jones & Co. criticized the purchase of the controlling interest in the North Dome mine by the Temiskaming. It was stated that the purchase had been made by Mr. Cartwright for his private interests and purposes, and they also stated that for several years past, he had conducted the affairs of the Temiskaming as a private enterprise, and not in the best interests of the shareholders. The evidence submitted at the trial showed that the purchase of the North Dome had been made strictly in accordance with Ontario laws and that Mr. Cartwright had for several years devoted most of his time to the affairs of the Temiskaming without any compensation.

Dome and Hollinger Costs compare as follows, the figures representing the results of the last fiscal year's operations: Ore milled, 45,195 tons at the Hollinger and 101,812 at the Dome; total assay value $933,681 and $1,043,994 respectively for the two mines, or averages of $21.44 and $10.25 per ton. Hollinger profits were $600,664 compared with those of the Dome of $509,956, the costs per ton milled were $6.74 and $4.95. Development work in the two mines totaled nearly the same, namely 5201 ft. for Hollinger and 5572 ft. for Dome, the respective reserves of the two companies being 644,540 tons and 566,000 tons. The annual meeting of the Dome Mines was held in Toronto May 27 at which the report covering the period from Nov. 30, 1911, to Mar. 31, 1913, was read. As the mill did not start crushing until March, 1912, the record covers but a period of one year. During this period the total ore mined was 128,015 tons, of which 102,836 tons were ore and the rest rock. A total of 101,812 tons was treated in the mill, giving a recovery of $10.25 per ton, or a total of $1,043,995. The gross earnings were $540,444 and net earnings, $509,956. A total of $138,728 was written off for development, general charges and fire loss, leaving a balance of $371,228. The operating costs were $4.95 per ton of ore milled, but this figure will be gradually and substantially reduced in the future. Several adverse factors incident with the starting up a new property in a new district, together with the high cost of power and labor troubles, have influenced the cost. Ore reserves above the 45-ft. level are estimated at 315,528 tons, having an average sampling value of $7.53 per ton. In addition to this, there are 250,000 tons developed between the 45- and 100-ft. levels which are ready for stoping, but on which sufficient work has not as yet been done to permit of an accurate valuation. This gives a total of 555,528 tons which is practically five years supply for the present mill. The presence of much larger bodies of ore is indicated by bore holes and development at the 260-ft. level, of the No. 2 shaft east of the original Dome, but no credit is taken for this ore nor for the reserves below the 100-ft. level. Nothing is considered ore except that which is actually ready to stope. The development during the period consisted of 155 ft. of shaft sinking, 866 ft. of raising, 1835 ft. of drifting, 2059 ft. of crosscutting, and 657 ft. of an incline. It is interesting to note that $560,481 worth of gold was recovered by amalgamation and $483,513, the remainder of the total, by cyanidation.

MEXICO, D. F.—June 1

The American Smelting & Refining Co. is operating its plants in Mexico in an irregular way, according to the ability to supply them with ore and coke. The railway situation is bad, owing especially to the destruction of bridges. Chihuahua and Matehuala are now running full, Aguascalientes and Monterey at partial capacity, while the Velardeña furnaces are idle. Out of a total of 35 furnaces in the five plants 18 are now in operation, smelting at the rate of about 1,200,000 tons per annum out of a total capacity for about 2,200,000.

THE MINING NEWS

ALASKA

THE FIRST STEAMER FOR BERING SEA, to leave Seattle this season, was the S.S. "Senator" that sailed June 2, for Nome, St. Michael, etc.; four other ships were to sail for the same ports the next day. All ships had booked a heavy passenger list and full cargoes.

ARIZONA

Cochise County

TOMBSTONE CONSOLIDATED—The validity of this company's bonds will soon be decided by the U. S. Circuit Court of Appeals. When the case is decided it is expected that development will be resumed.

COPPER QUEEN—A call for bids from contractors for the construction of a new precipitating plant at Bisbee has been issued. The new plant is to be near the ice plant of the Bisbee Improvement Co., and will take the place of the old plant at the Czar shaft.

SHATTUCK-ARIZONA—Development work is progressing satisfactorily. Crosscut 26 on the 400-ft. level is 72 ft. long, the last 18 ft. being in hard limestone. Crosscut 29 was advanced 12 ft. in good copper ore. Raise 79 is up 49 ft. the last 21 ft. being in siliceous gold-silver ore which will assay about 1 oz. gold per ton. Crosscut 41 is now 104 ft. in length and from it a raise will be made to develop the lead shoot. Intermediate "B" in raise 69 has a total length of 51 ft. in good carbonate ore. Crosscut 34 on the 600-ft. level has been driven 224 ft., but work in the face has been discontinued to follow an 18-in. streak of 20% copper ore which was cut about 4 ft. back from the face. Shipments to the Calumet & Arizona smeltery are being kept up at the rate of 250 tons daily, and will be doubled on the completion of the new equipment; 50 tons of lead ore are being shipped to the El Paso smeltery daily.

Gila County

MIAMI—The mill is still working somewhat below its normal capacity as a result of the cave-in of Apr. 17, but the management expects soon to be milling as much ore as ever.

APACHE—This group, in Richmond Basin, is again shipping ore to the Old Dominion at Globe. Pfeister Bros., of Globe, owners of the group, have leased it to the present workers of the property. The ore now being shipped contains 25% copper and is rich in iron. The ore is packed 12 miles from the mine to Globe by burros.

INSPIRATION EXTENSI N—At this property adjoining the Inspiration Consolidated on the north and west, a small force of men is clearing ground preliminary to sinking a shaft. Sinking will be begun within a fortnight. A 25-hp. gasoline hoisting engine is being moved to the site of the shaft and a headframe will be erected in a few days.

SUPERIOR & BOSTON—Relief from car shortage during the last days of May resulted in steady shipping at the rate of three 50-ton cars daily, a rate that the management expects to maintain. The 1000-gal. pump was moved from the 1200-ft. level to the tenth level, June 1. The amount of water being made by the mine is normally 1,200,000 gal. daily.

IRON CAP—The management predicts a June output of 500 tons of high-grade ore; its prediction of 300 tons output for May was exceeded. No crosscuts, winzes or raises have been made on the ore which has been followed, two sets wide, on the 650-ft. level for 471 ft., exposing an average width of 12 ft. However, a raise has just been started 20 ft. back from the face of the drift, and it will be lifted to ascertain the height of the ore; crosscuts and winzes will also be made. The ore assays about 12% copper and there is a streak of high grade in the center, measuring from 12 to 24 in. in width, which assays as high as 50% copper and 100 oz. silver.

ARIZONA COMMERCIAL—At the Copper Hill shaft sinking has been discontinued at a depth of 1200 ft. and a sump and station are being cut. The pump station will be ready for installation of the pump about June 15. This pump will be of the same general type as that used in the Old Dominion mine, an Aldrich vertical triplex electric pump designed for a 1200-ft. lift. With the discontinuance of sinking the more thorough development work, which has been planned, will result in opening considerable sulphide ore which is known to exist in the vicinity of the Copper Hill shaft. Surface shipments during the last few months have been irregular because the ore is rather siliceous and the profit from its sale varies widely. The ore is now shipped only when the demand for siliceous ore is heavy.

INSPIRATION CONSOLIDATED—An injunction was recently issued out of Judge Shute's court at Globe, restraining the company from continuing work on its main transportation drift through New Keystone ground until the formal hearing, June 16. It has finally been decided to use compressed air instead of electricity for underground haulage. The air will be supplied by compressors near the main east and west shafts to distributing stations throughout the mine. The flotation tests at the experimental mill are understood to be wholly satisfactory to date, the only seeming failure having been experienced when the chalcocite in granite gangue instead of the customary schist was treated. As soon, however, as the difference in the ore was realized, the trouble was promptly overcome.

Maricopa County

MAX DELTA—Sinking in the main shaft has been resumed, a depth of 275 ft. having been attained.

RELIEF—This mine, 28 miles northwest of Phœnix, has just shipped a bar of bullion weighing 68 oz., produced at a recent cleanup of the lately built cyanide plant.

SUNFLOWER CINNIBAR MINING CO.—This company has been formed by New England men and has purchased a group of claims in the Matzatzal Mountain from Bowman & Murphy. It is stated that a retort furnace will soon be built.

VULTURE—A Word drill sharpener was recently installed at this Wickenburg mine. A Donaldson tilting furnace is now used for melting bullion, and further improvements include electric lighting of the camp and the installation of fire hose in the mine as a measure for safety.

ARIZONA PORTLAND CEMENT CO.—This cement plant at Portland, six miles east of Phœnix, has just been put in operation. The clay which is used in the manufacture of the cement is obtained three miles west of Phœnix on the Buckeye & Phœnix R.R. The limestone is obtained near Winkelman, on the Phœnix & Eastern R.R.

Mohave County

MONO WOOD—A small shipment made recently to the Needles smelter returned 59.7 oz. of silver, 15% copper and 4% lead. Considerable development has been done and it is expected that in the near future the property will be operated on a larger scale.

GRAND GULCH—The company is trying out a 37-hp. traction engine with a hauling capacity of six tons. More than a dozen round trips have been made between the mine and St. Thomas, the terminus of the new branch of the Salt Lake Route from Moapa, Nev. The haul is 45 miles. The traction outfit with a load of five tons makes the round trip in 20 hr. as against the 5½ days consumed by the teams hauling from five to six tons.

Pima County

PLUMED KNIGHT—The first of a series of payments extending over five years was recently made by the Pioneer Smelting Co.

PIONEER SMELTING CO.—This company, of Tucson, will in the next few months undergo a complete reorganization by E. Hicks Herrick, of the firm Butler, Herrick & Kip; Girard P. Herrick of the Girard Development Co. and Garret B. Kip are inspecting the properties of the company. The holders of 51% of the stock and 80% of the debentures have agreed to the proposed plan. The securities of the old company will be exchanged for securities in the new with a cash bonus.

Santa Cruz County

ARIZONA-EUROPEAN—Regular shipments will be made daily to Douglas in the future instead of semi-weekly as before.

SPOKANE-ARIZONA—Development work is progressing rapidly and with good results. Considerable 40% zinc ore is being taken out of the new shaft which is being sunk by contract.

Yavapai County

BROOKLYN-ARIZONA—Frederick E. Small and A. Calvin Cruchet, officers of this company, have been arrested by Federal officers, they having been indicted by the Federal grand jury sitting in Boston, Mass., and accused of promoting a fraud. Small was arrested in Arizona; Cruchet in Boston. The Brooklyn-Arizona property is on Squaw Creek, about 20 miles southeast of Mayer. It has been suspected for several years that fraud was being perpetrated.

CALIFORNIA

Amador County

NORTH PLYMOUTH MINING & MILLING CO.—This company was recently incorporated with capital stock of $150,000 to develop property 1½ miles north of the town of Plymouth, consisting of 3½ claims of a total length of 5280 ft. along the strike of the Mother Lode.

GAGLIARDO VS. SOUTH EUREKA—In this suit for $25,000 by the administrator of the estate of Andrew Gagliardo, who was killed in the mine by an electric shock while operating a drill, the evidence failed to show negligence of the company and the court instructed the jury to render a verdict for the defendant.

Butte County

DREDGES IN OROVILLE FIELD that are dependent on the Pacific Gas & Electric Co. for power have been temporarily closed down on account of the burning out of the substation. A new distributing station has been built by the Oro Water, Light & Power Co., to furnish power temporarily.

BERRY CREEK—A new rock crusher is being installed at this mine at Berry Creek. John Kinkaid is superintendent.

CRYSTAL HILL—The breaking of a piston in the new air compressor caused a temporary closing down of this mine at Magalia. The old compressor is still intact and has been used temporarily.

Madera County

JESSE BELL—This copper mine is seven miles from the Copper Queen in Mariposa County and in the same belt. The mine is leased by Daulton Bros., and is producing rich copper-carbonate ore which contains gold and silver. Shipments are made to the Selby reduction works.

Mariposa County

COPPER QUEEN—This mine was leased last November by Feltz, Bradford & Ives, who sunk a shaft 125 ft., striking sulphide ore 10 to 20 ft. wide, which contains 15% copper, according to returns from the Kennett smeltery. At a depth of 50 ft. there is a carbonate oreshoot which is as yet undeveloped, but it is thought that developments will result in this shoot yielding as much if not more ore than the sulphide shoot below. The copper-mining industry in this part of the county is said to be more prosperous now than it has been for years.

Modoc County

BIG FOUR—This property in the Highgrade district is reported to have been sold for $60,000.

SUNSHINE-HIGHGRADE—Recent returns from samples taken from the Yellow Jacket claim of this group of mines, worked under lease by the Spearmint Gold Mining & Leasing Co., are reported to have assayed from $22 to $24 per ton. Some samples were much richer but were not taken into account in estimating the average for the mine. There is a small amount of high-grade ores in the camp. The miners in the Highgrade district seem to be getting down to practical work this season.

Placer County

MOUNTAIN CHIEF—This is an undeveloped gravel mine on which a shaft has been sunk and the rim of the channel has been reached showing fair prospects of gold. By joining with two other properties below the Mountain Chief about five miles of an old river channel could be opened by driving one tunnel.

Sierra County

LADIES CANYON—Lee Bros. have bonded their quartz claims to R. D. Gillespie, of Pittsburgh, Penn., who will at once begin development work. Dan McGonigal has charge.

TIGHTNER—A wagon road is being built from the mill and lower tunnel to the town of Alleghany, to be used in hauling in machinery and the additional 10 stamps that are to be installed this summer.

BRANDY CITY—After interference by heavy storms these hydraulic mines are again in operation with a full head of water and a force of 40 men. George F. Taylor, of Downieville, is superintendent.

WIDE AWAKE—This gravel mine, owned by Downieville men, has been bonded to J. S. Frye and associates, who have begun extensive development work which will be continued throughout the summer and autumn.

BEAR CREEK—At this quartz mine, near American Hill, a steam plant is to be installed to furnish power for sinking several hundred feet deeper on the vein; a tunnel is also contemplated. Later, a reduction plant may be built on the Middle Yuba River. J. W. Evans is superintendent.

MONTE CRISTO—These old gravel mines, near Downieville, which have yielded richly during the three last years, have been sold to Thomas E. Winrod, who has had the works resurveyed and now has a force of men driving a drift toward a supposed continuation of the channel that was worked by former owners.

MOUNTAIN—This old mine, which for more than 10 years has been in litigation, has been put into the hands of Frank R. Wehe as trustee. All suits have been dismissed, taxes paid and matters are being cleared up looking toward an early reopening of the property, which is regarded as one of the most promising in the Sierra City district.

RAINBOW—At this quartz mine, near Alleghany, at which all buildings were recently destroyed by fire, the erection of a complete new plant is about to be commenced, notwithstanding the heavy loss, with no insurance. The property is under bond to Denver investors who have about completed payments for its purchase. L. P. Woodbury is in charge.

DRAGON FLY—Development work has been in progress on this property for the last seven years and a rich pay streak was found about Mar. 1, 1913. The gold is coarse and one nugget was taken out a few weeks ago that weighed 7 oz. 13 dwt. The gravel contained about $7 in gold per load during May. Squire & Simmons, of Downieville, are operating the property.

MOUNTAIN HOUSE—Development thus far at the gravel mines located last fall by Alling & Belcher, shows a fine body of gravel averaging $6 per load. The deposit has been prospected by 250 ft. of drifts, and a 135-ft. crosscut has failed to strike either rim of the ancient channel. The property is under bond to Shaw Bros., of Oakland, who have retired from their brokerage business there to take personal charge at the mine. V. G. Helmet is superintendent.

SIERRA DEL ORO—Underground work was carried on all winter, which proved that the rich discovery of last August continues with depth. A 4½-lb. specimen was recently taken out, and many smaller ones, while all ore is of high milling grade. This mine was formerly known as the Ironsides, and is in the Jim Crow Cañon territory, which embraces the belts of porphyry, slate and diorite, between Harris Meadows and the Downieville serpentine contacts. Many rich pockets have been mined in this territory in the past.

Trinity County

VAN METER—A bond has been taken on these placer claims by Sacramento Valley men, who will prospect with Keystone drills. If the results warrant a bucket-elevator dredge will be installed. H. E. Cheesebro, of Chico, and E. E. Todd, of Redding, are interested in the venture.

Tuolumne County

JUMPER—The shaft is being repaired and will be deepened 600 ft. A carload of steel rails and two carloads of Oregon pine have been received to be used in the repair work.

CARLIN—The 500-ft. tunnel has been cleaned out and a 25-ft. winze has been sunk on the vein. A new shaft will be sunk. The property is being reopened by J. D. Powell and others of Sacramento.

COLORADO

Clear Creek County

SILVER PLUME BOARD OF MINES AND TRADE is raising funds to repair and improve the Loveland Pass road from Silver Plume to the top of the range. About half of the amount required has already been collected.

TREASURE VAULT—The east drift has been advanced 190 ft. from the botom of the shaft in pay ore.

RULER—Development of this property on Griffith Mountain has been resumed. A contract has been awarded to advance the upper tunnel.

FIREMEN & CONDUCTORS—This property, at Dumont, is being developed by lessees under the management of H. J. Theide. A 12-in. vein of pay ore has been opened.

INDEPENDENCE—This property is being developed by John Hansen & Co., lessees, through the Wilcox tunnel. The management anticipates a production of 10 tons of smelting ore per day.

CENTENNIAL—This property on Leavenworth Mountain, is to be systematically developed. The main adit is to be advanced, and it is proposed to unwater the lower workings and resume development in the 500- and 600-ft. levels.

JOSEPHINE—This Kelso Mountain property is producing silver-lead ore worth $50 per ton at the rate of eight tons per day. The company anticipates an early increase in tonnage as soon as transportation facilities are improved. The product is sold to the Chamberlain-Dillingham Ore Co. at Idaho Springs.

TERRIBLE-DUNDERBERG—This group of properties on Brown Mountain has been secured under lease by a group of Boston men headed by R. A. Carnahan. It is proposed to reopen and develop the property thoroughly. The unwatering of the shaft workings is in progress, and as soon as the lower levels are accessible they will be explored and placed in working order. The company anticipates the rapid development of pay ore in the lower areas of the Dunderberg vein, and contemplates starting the 50-ton concentrating mill at an early date, for the purpose of treating dump material and filling from the old stopes until stoping ground is opened by the new development.

STANLEY—During May the fifth level west heading was advanced 117 ft. to a total length of 2252 ft. The vein is 2 ft. wide. Crosscut No. 4 north was advanced 20 ft. The road adit level of the mine has been cleaned out, retimbered and placed in working order. The machinery in the Salisbury mill has been turned over and within a few days the mill will be in operation. It is proposed to treat ore from the Stanley dumps, which contain approximately 100,000 tons of material estimated to average $2 per ton. As the mill is operated by water power, the cost of concentration is low. The company's compressor plant, which is also operated by water power, supplies air for mining and pumping in the Stanley mines, and the surplus is sold to companies operating in the neighborhood. Harry J. Wolf is manager.

Pueblo County

U. S. ZINC CO.—Employees of this company's zinc smelting plant at Blende, near Pueblo, have demanded an increase in wages. Because of the shorter day imposed by the enactment of the 8-hr. law, the men demand an increased time scale, and about 150 went out on strike June 5 in an attempt to enforce this demand.

San Juan Region

BROWN MOUNTAIN SMELTING CO.—The reduction works at Ouray will be started in July, and about 40 men will be employed.

TOMBOY—In May, 12,000 tons of ore was treated, the recovery in bullion and concentrates being worth $84,000; $33,709 was the net profit.

IOWA-TIGER—New shoots of rich ore have been opened by lessees in new ground and the mine force will be increased. The mill is making a fine output.

FORESTER MILL—It is stated that commercial success has attended the operating of this mill during the last eight months, zinc concentrates from the Atlas, Revenue, Barstow and Micky Breen mills being treated by the Huff electrostatic process.

SILVER LEDGE MILL—This mill, at Chattanooga, which has been leased by Joseph Warner, is to have a capacity of 150 tons per day, and will be operated as a customs mill. If sufficient quantities of siliceous gold and silver ores can be obtained, an amalgamation and cyanidation plant will be added to the present concentrating and zinc separation mill.

Teller County—Cripple Creek

MARY McKINNEY—A 15-hp. hoist has just been installed at the Grace Greenwood shaft.

FREE COINAGE—The Wrockloff shaft, at Altman, 500 ft. deep, will be sunk to the 800-ft. level by Goldsworthy & Doherty, who have secured a lease.

STRATTONS' INDEPENDENCE—The directors in London declared the usual dividend of $60,000 or 10% on the capital stock of $600,000, May 31. This makes the second 10% dividend for the fiscal year ended June 30, 1913.

RIGI—This mine, which was purchased by an English company, has been idle for some time and is now being operated by the Battle Mountain Leasing Co. The first carload of ore has been shipped. The mine will now be developed systematically and the oreshoots will be opened up ahead of extraction.

GRANITE—This property, on Battle Mountain, which includes the Gold Coin, Dillon, Mary Cashen and Monument, and which has been closed down for repairs, has resumed production. The plant and the mine are now at the highest standard as regards working condition and the production will be from 70 to 80 carloads per month.

IDAHO

Coeur d' Alene District

MORNING—An employee in charge of a rock chute on the 1200-ft. level of this mine of the Federal Mining & Smelting Co. was killed, May 23, by a run of waste falling upon him.

ILLINOIS

La Salle County

ILLINOIS ZINC CO.—An attempt was made by masked men to hold-up the paymaster's wagon while approaching the Black Hollow mine. A police officer, acting as a guard for the company's men, was killed and three other men in the paymaster's party were injured.

LOUISIANA

Caddo Parish

THE BURNING GUSHER known as Stiles No. 96, one-half mile from Trees City, near Lewis, caught fire 8 a.m., May 25, and was extinguished May 29. About 400 men were employed in the fire-fighting squad and live steam from 44 boilers was directed through 4-in. pipes so that it was possible to extinguish the flames for a height of 30 ft. above the ground. While protected by a heavy stream of water, men succeeded in closing a valve over the bore while the steam choked the flames.

MICHIGAN

Copper

LAKE MILLING, SMELTING & REFINING CO.—This company is erecting a new boiler house adjoining the mill, which will have a capacity of about 2500 hp. The mill contains six stampheads, three of which are stamping Allouez ore and one each Superior and Centennial ore.

NEW ARCADIAN—Sinking at this company's shaft is progressing satisfactorily and at a depth of about 750 ft. which will be reached early next month, lateral work will be started to open the three parallel formations at that depth. An assessment of 50c. per share on the outstanding 150,000 shares of stock has been levied, payable July 1, 1913.

WOLVERINE—Work has been suspended at the exploratory shaft on the Osceola lode. This shaft was sunk to a considerable depth and lateral openings were extended, but while some good ground was opened, nothing of consistent commercial value was developed. The equipment will be dismantled and the working force transferred to the main mine.

SOUTH LAKE—The shaft at this property is about 440 ft. deep and is being sunk in trap. A crosscut from the 300-ft. level has been extended about 60 ft. and should reach the formation in the near future. A station has been established at the 400-ft. level and the crosscut has been started. Sinking will be continued until a depth of about 600 ft. will have been obtained, when the next lateral opening will be started.

OJIBWAY—Active mining operations have been suspended owing to a depleted treasury. The company has been operating for about five years and sank two shafts in the foot wall of the lode to a depth of about 2000 ft. This work was done after several well mineralized drill cores were taken from the Kearsarge lode. The shafts showed the formation to be badly shattered and while some ground was well charged with copper, a mill test showed that the formation did not carry the metal consistently enough to make it commercially valuable, although the lower workings showed the formation to be more settled and of uniform character. There are 84,000 shares of stock outstanding with $10 paid in and five assessments called.

MONTANA

Butte District

LEONARD—At the old or No. 1 shaft, a man was killed and one was injured, May 24, when a single-deck cage was overwound. The man was killed by being caught, while riding the cage, by the sheave supports.

BIG BUTTE—This company is preparing to develop its property consisting of 20 acres of mineral ground southwest of Timber Butte, and a leased and bonded claim, the Carey, west of Walkerville. On this claim a tunnel has been driven 287 ft. and a crosscut has been driven 65 ft. to the vein. A raise is being cut to the surface from the tunnel, and when it is completed, sinking will be started.

PILOT-BUTTE—Station cutting has been completed on the 1800- and 2000-ft. levels, and crosscutting to the veins has been started. In anticipation of largely increasing the number of miners in the near future, a new and larger air-compressor has been ordered. It is believed that commercial ore will be encountered within another month, as good ore was encountered a short distance above in the shaft.

NORTH BUTTE—The Adirondack vein in the Speculator mine was recently found again west of the fault on the 2400-ft. level. The ore where encountered is 10 ft. wide, assaying 5% copper. Some time ago the company entered into a new arrangement with the Anaconda company for the treatment of its ore at the Washoe reduction works at Anaconda. By the new agreement North Butte, after paying smelting charges, receives the copper and acts as its own sales agent, instead of selling the ore direct to the smelting works as was formerly done.

GAMBRINUS—The Corbin Copper Co., which recently acquired this property on the west side of Butte, is installing an electric hoist, which will probably be ready for operation in about two weeks. The shaft has been sunk, three compartments wide, to a depth of 50 ft. by a windlass, and with the new hoist sinking will be continued to the 1500-ft. level at least, before lateral development work of consequence is done. A well defined vein has already been cut in the shaft, and excavations for the surface buildings are showing good mineralization; so that the management is confident of striking commercial ore comparatively near the surface, although this will not be allowed to interfere with the plan of sinking to great depth with all haste.

Lincoln County

A MODERN GOLD DREDGE is to be built according to the plans of P. J. Brophy, of Butte, to operate on a group of placer claims on Libby Creek south of Libby. To date the mines have been worked by hydraulicking, but the fall of the gulch is insufficient to permit cleaning the bedrock thoroughly by the ground sluice. Also the bedrock upon which work has been done so far has been proved to be a sort of false bottom, below which gold is found for an undertermined distance. For these reasons a dredge is believed to be the only practical way of working the gravels.

MISSOURI—George McKay, Duncan McDonald, Charles McDonald, and S. G. Ratekin, owners of the Missouri group of claims on Leigh Creek, 15 miles south of Libby, have begun development work at the property. Two shifts of men are employed driving a crosscut tunnel to the vein, which contains gold, silver and copper.

NEVADA

Humboldt County

A NARROW-GAGE RAILROAD, it is reported, has been purchased by the Codd and Big Four leases, and will be laid between Oreana, on the Southern Pacific, and Nenzel Mountain.

NEVADA PACKARD CO.—This property, two miles east of Rochester, is now shipping $40 ore to the Hazen sampler. This ore is being mined from a recently discovered shoot near the surface.

ROCHESTER-BELMONT—This company has eight sets of lessees working on its Sunflower, Sunflower No. 2 and Little Sunflower claims. Six parallel oreshoots have been opened. The company is sinking a shaft on a reserved portion of the Little Sunflower claim. On the Sunflower claim, the Nenzel company will start a tunnel to cut its main vein at depth. This tunnel will also develop a portion of the Sunflower claim.

Lyon County

MOHAWK—A rich copper strike has been made on this group in a crosscut from the shaft at a depth of 50 ft.

COOPER—Much development has been done on this property, which will commence shipping in the near future.

BLUE STONE—The magnetic concentrating plant at this mine is again in operation. The furnace has been enlarged, and a new crusher and rolls have been installed. The capacity is now about 60 tons daily. A test run of long duration will now be made.

MASON VALLEY MINES CO.—Ore shipments to the Thompson smeltery for the week ended May 29, 1913, were as follows: From Mason Valley mine, 2211 tons; from Nevada-Douglas, 1360 tons; from other mines, 865 tons. Total, 4436 tons, or a daily average of 634 tons. During the same week seven cars of Matte were shipped from the smeltery.

Mineral County

AURORA—Machinery and supplies for the Aurora mill will be hauled from Hudson by auto trucks, a company having been organized for that purpose.

ANDERSON—This group of five claims is under lease and bond to the Mason Valley Mines Co. It is situated 4½ miles east of Luning, and adjoins the Nevada Champion Copper Co. ground. Development is being done in the Bockman and Finney tunnels, and in the south drift from the bottom of the winze. About 20 tons of ore daily is being mined in the glory hole. The ore is hauled to Luning by wagon and auto truck.

Nye County

TONOPAH MERGER—The east and west drifts on the vein on the 1170-ft. level show full faces of ore assaying from $20 to $25 per ton. Shipments at the rate of 200 tons weekly are being maintained to cover current expenses.

TONOPAH EXTENSION—In May, a total of 5008 tons of ore was treated, an average of 162 tons daily, the gross value of which was $63,200. The new main shaft, which is now 950 ft. deep, is to be sunk 200 ft., and prospecting will be done at that depth.

NORTH STAR—Three raises are being put up in ore from the 950-ft. level. The east hanging-wall raise shows 8 ft. of ore assaying from $50 to $60 per ton, and the west hanging-wall raise shows 8 ft. of ore assaying from $70 to $100 per ton. The east foot-wall raise shows 3 ft. of ore assaying from $30 to $50 per ton. During the month of May shipments of ore realized a net profit of $15,000. Drifting on the vein on the 1050-ft. level is in progress in milling ore, but the oreshoot has not yet been encountered.

SHIPMENTS in tons from Tonopah mines for the week ended May 31 were as follows:

Tonopah Mining	3,800	North Star	200
Tonopah Belmont	3,802	Mizpah Extension	....
Montana-Tonopah	1,623	Jim Butler	450
Tonopah Extension	1,135	Tonopah Merger	200
West End	1,050		
Midway	50	Total	12,257
MacNamara	547	Estimated value	$264,970

White Pine County

NEVADA CONSOLIDATED—Preparations are being made to begin mining the Ruth ore, which will be raised through the Star Pointer shaft which was sunk for that purpose six years ago. Operations at the Veteran will then practically cease.

GIROUX—Two men were killed and another seriously hurt, June 6, in a cave-in at the Morris mine. Several accidents have occurred recently at this property and the morning shift refused to go on duty after the last accident, until the state mine inspector had arrived at the property.

OREGON

Josephine County

PLACER PROPERTY NEAR GOLD HILL, of an area of 140 acres, has been purchased by a company represented by C. F. Luce, of Tacoma, Wash., who will install modern hydraulic machinery.

MINES CONSOLIDATED CO.—This company is making preparations for operations on its property on Lower Grave Creek. Col. Blaisdell, Portland, is manager.

TEXAS

El Paso County

THE STRIKE AT THE SMELTING PLANT is about broken and nearly two-thirds the normal number of men are working.

UTAH

Beaver County

MOSCOW—Arrangements for sinking a new shaft on this company's property have been made.

Juab County

TINTIC SHIPMENTS for the week ended May 31 amounted to 180 cars. The output for May, five weeks, was 902 cars. Of the months preceding, the next highest record was made in January, with 875 cars. February shipments amounted to 700 cars; for March, 775, and for April, 734 cars.

UNCLE SAM—Lessees are working old stopes with satisfactory results.

LOWER MAMMOTH—A raise is being lifted from the 1500 in ore recently opened. Two cars have been shipped from this find.

DRAGON CONSOLIDATED—Regular shipments are being made from the copper ore opened through the 300-ft. level of the Black Jack.

MAY DAY—This company is stated to be considering the advisability of discontinuing shipments of zinc ore for the present, owing to the low price of spelter.

BALTIMORE CONSOLIDATED—Development work is to be started immediately with funds provided by a recent assessment. At the stockholders' meeting held May 31, J. F. Johnson was elected president.

EAGLE & BLUE BELL—The new ore on the 1350-ft. level has been drifted on for 100 ft., and a raise has been lifted for 70 ft. in ore. Drifting on the 1250 has encountered the same oreshoot. Twelve cars were shipped the week ended May 31.

BECK TUNNEL—At the annual meeting held June 3, the old board of directors headed by Jesse Knight was reëlected. Production for the year is given as 6418 tons of ore, valued at $72,000. It is stated that old workings are to be surveyed, and the greater part of the property will be given over to lessees.

CROWN POINT—The annual stockholders' meeting was held June 2. Receipts for the year were $15,841, including $434 cash on hand June 12, 1912, treasury stock sold amounting to $674, $5955 received from contracts, and assessments Nos. 3 and 4 of $8776. Disbursements were $15,841. There remain 108,027 shares of stock in the treasury. The manager's report showed that 1500 ft. of development work was done, on the 550-, 500- and 400-ft. levels. No ore was opened but there have been favorable indications, and development will be continued.

Salt Lake County

NEW UTAH-BINGHAM—A contract has been let for sinking the new shaft now 50 ft. deep to the 150-ft. level. This company's stock was recently listed on the New York curb.

ALTA CONSOLIDATED—A good tonnage of ore has been accumulated, and this will be hauled as soon as ore teams are available. Development on the upper levels is temporarily handicapped, owing to spring thaws.

SOUTH HECLA—Teams are busy hauling ore, of which there is about 500 tons on the dumps and in the bins. There is stated to be enough ore exposed in the mine to make continued shipping possible during the summer.

Summit County

PARK CITY SHIPMENTS for May amounted to 7764 tons. Shipments in pounds were as follows: Silver King Coalition, 6,984,900; Daly-Judge, 4,816,320; Daly-West, 3,424,400; Silver King Consolidated, 157,860; American Flag, 145,000.

WISCONSIN

Platteville District

COKER—This old mine at Livingston, although 30 years old, is still producing.

BAXTER—This mill at Cuba is recovering 5 or 6 tons of concentrate per day from old tailings.

KING BEE—Cleveland men are drilling on this Hazel Green property with encouraging results.

NORTH POLE—Local miners have opened a strong lead range on the James Calvert land, at Benton.

EAST ELMO—A company of Platteville men is prospecting the Faherty land two miles north of Cuba.

GRUNO—This company has moved its mill and commenced operations on the Bainbridge land at Mifflin.

VINEGAR HILL—This company has taken over the Eadie lead mine 3 miles west of Elizabeth and is installing new pumping equipment.

MAUSBRUCH—This mine is near Platteville and was formerly known as the Big Patch; it has started up operations with a 125-ton mill.

KENNEDY—After 20 years of production, this mine at Hazel Green is making the greatest output in its history. Production is about one car per day.

WYOMING

Fremont County

IN THE CONANT CREEK OIL FIELD, one derrick has been erected, and several leases are pending. The field has not been proved, but the indications are good. It is about 40 miles east of Lander.

TO PROMOTE INTEREST IN ATLANTIC CITY, Lewiston and South Pass mines, a commercial club has just been organized at Atlantic City, which will supply anyone interested with information about the mineral deposits of those towns.

CARISSA—San Francisco men have examined this property.

MARY ELLEN—The new Denver quartz mill, purchased for this mine, has been installed, and operations will be started on a small scale.

BECK MINING CO.—Operations will be resumed June 2, after a shutdown of three months, because of the poor condition of the roads for freighting.

X L PLACER CO.—For three weeks now this company has been hydraulicking on Beaver Creek, below Miners' Delight. This work at the present time is largely in the nature of prospecting or proving the ground.

GARFIELD—This mine has been unwatered to the second level. It will be entirely unwatered and examined by lessees now in charge. Two new veins carrying good ore have been discovered, but little work has been done on them yet.

CANADA

British Columbia

LUCKY JIM—Plans for leasing and remodeling a concentrator of 100 tons daily capacity are being considered by the directors of the company, according to a statement made by T. G. Proctor, the managing director. This, it is calculated, will release for profitable treatment milling ore above the fifth level estimated to have a net value of $217,000 after the duty has been paid. The mill in view is one built at Roseberry about 15 years ago by Morris Gintzburger. Shipments from the mine aggregated 250 tons for the first 12 days of May.

GRANBY—The new dam that was being built in connection with the hydro-electric power installation, about two miles from Granby Bay, has burst. It is stated that the whole of the heavy base on which the dam was being built was taken out by flood waters, which also made a clean sweep of everything in the cañon across which the dam was being built. The old power station was also swept away. This disaster will delay the completion of the work being done to provide for commencing the smelting of Hidden Creek ore this year, for although the damage did not extend to the works site, arrangements to provide power for current operations at the mines must be made before construction work on the dam can be resumed. The money loss is locally stated to be about $100,000. The loss of life was restricted to one Austrian workman and a Japanese woman.

Ontario-Cobalt

SENECA SUPERIOR—A third dividend of 10% has been declared, which will bring the total amount distributed to shareholders up to $150,000.

SHIPMENTS of ore and concentrates in tons, from Cobalt for the week ended June 6 were as follows:

Bailey	.....	La Rose	.....
Beaver	27.18	Lost and Found	.....
Buffalo	33.18	McKinley-Darragh	30.61
Casey Cobalt	.....	Nipissing	38.76
Chambers-Ferland	.....	Nipissing Reduction	.....
City of Cobalt	37.70	O'Brien	32.05
Cobalt Lake	32.21	Penn.-Canadian	.....
Cobalt Townsite	43.70	Provincial	.....
Colonial	.....	Right of Way	.....
Coniagas	71.33	Seneca Superior	.....
Crown Reserve	.....	Silver Bar	.....
Dominion Reduction Co.	.....	Silver Queen	.....
Drummond	.....	Timiskaming	.....
General Mines	.....	Trethewey	23.96
Green Meehan	.....	Wettlaufer	.....
Hargraves	.....	York	.....
Hudson Bay	41.30		
Kerr Lake	.....	Total	411.98

Yukon Territory

LONE STAR, LTD.—Some fine ore has been encountered at this mine in the Klondyke district, and a four-stamp mill is now in operation.

CANADIAN-KLONDYKE—This company will have two dredges in operation this season, which will more than double the output of last year. Each will have a capacity of 10,000 cu.yd. daily.

YUKON GOLD CO.—Four of this company's dredges on Bonanza Creek have started for the season, and the others will get under way just as soon as the ice goes out. The dredges at work are No. 2 in the 50's, and No. 3 and No. 6 in the 70's, and No. 5 on 17, all below discovery on Bonanza Creek.

MEXICO

Sonora

DEMOCRATA—About 300 men are employed in the mine and reduction works. The old plant of much smaller capacity is being overhauled and will be put in commission soon.

PENN-SONORA—This company operating the old Durango mine southwest of Nogales has recently put its new mill in operation.

CERRO DE PLATA—This property west of Cumeral is operating quite steadily. The last shipment contained 2330 oz. of silver per ton. The property is being operated by Holt Bros., of Magdalena.

THE MARKET REPORT

METAL MARKETS

NEW YORK—June 11

The metal markets have been more inclined to activity. Fluctuations in copper were small, and lead is firm. The speculation in tin continues active.

MONTHLY INDEX NUMBERS

Month	1912	1913	Month	1912	1913	Month	1912	1913
Jan.	111	126	May	118	126	Sept.	127	...
Feb.	109	125	June	117	...	Oct.	133	...
March	111	125	July	114	...	Nov.	129	...
April	115	124	Aug.	120	...	Dec.	129	...

Average for year 1912, 119; year 1911, 112; year 1910, 115; year 1909, 115
Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Copper, Tin, Lead and Zinc

Copper—The world-wide process of liquidation continues to have a depressing influence on the market. Consumers fear a serious contraction in their business at an early date, and toward the close of the week the market is practically lifeless. Toward the end of last week the concessons offered from previous prices attracted a small volume of business. While the large sellers have not reduced their limits, considerable copper is offered from other sources, and it seems that the only deterrent to still lower prices is the fact that there are no orders of sufficient magnitude to develop competition. The close is weak at 14¾@15c. for Lake copper, and 14.70@14.80c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 14.45@14.55c. as an average for the week.

The standard market has again broken seriously on account of the liquidation of speculative holdings and heavy short selling. At the close there is a slight rally, quotations being cabled as steady at £65 10s. for spot, and £65 7s. 6d. for three months.

Operations are shortly to be resumed at the smelting works at Norfolk, Va., by W. E. C. Eustis, with whom Beer, Sondheimer & Co. will be interested.

Base price of copper sheets is now 21@22c. per lb. Full extras are charged and higher prices for small quantities. Copper wire is 16@16¼c. per lb., carload lots at mill.

Copper exports from New York for the week were 6283 long tons. Our special correspondent gives the exports from Baltimore at 1274 tons for the week.

Tin—The liquidation which was apparent in this metal has been continued, and values have declined considerably. Especially was this the case so far as spot tin was concerned, so that three months tin has been quoted at higher prices than spot—something which has not happened for a great many months. Spot material was also pressed for sale in this market, practically the only position which attracted buyers, future tin being almost entirely neglected. The close is somewhat firmer at £206 5s. for spot, and £206 10s. for three months, and at about 45¼c. for June tin here.

Lead—The market is unchanged at 4.17½@4.20c. St. Louis, and 4.30@4.35c. New York.

The unsettled conditions in Mexico and the consequent falling-off in shipments of lead bullion from there have brought about a further advance in London, and quotations at the close are cabled at £20 7s. 6d. for Spanish lead, and 7s. 6d. higher for English.

Spelter—Business has been in smaller volume in spite of the lower prices which are offered from all sides. The unsettled general conditions are dominating the policy of sellers and buyers alike, although prices have reached a point where in a great many cases they leave the miner as well as the smelter a loss. The close is weak at 4.85@4.95c. St. Louis, and 5@5.10c. New York.

The situation in Europe is reported as being rather precarious on account of the heavy surplus which has accumulated there, and quotations at the close have declined to £22 5s. for good ordinaries, and £22 12s. 6d. for specials.

June 7 the base price of zinc sheets in carload lots was reduced 25c. per 100 lb. to $7.25 per 100 lb. basis, less 8% discount, f.o.b. cars Peru, Ill. Extras and discounts unchanged.

Exports from Baltimore this week included 616,060 lb. spelter to Liverpool.

Imports and Exports in Great Britain of metals other than iron and steel, are reported for the four months ended Apr. 30, as follows, in long tons, except quicksilver, which is in pounds:

	Imports 1912	Imports 1913	Exports 1912	Exports 1913
Copper	43,455	46,042	18,506	33,813
Tin	16,485	15,467	19,164	14,854
Lead	69,006	73,507	15,880	19,565
Zinc	42,641	46,202	2,731	3,125
Quicksilver, lb.	2,342,284	2,130,702	806,923	913,056
Minor metals	2,369	2,864	8,273	10,159
Ores, etc.:				
Tin ore	10,071	10,947	.....	.....
Pyrites	311,388	314,473	.....	.....

Exports include reëxports of foreign material. Copper figures include metallic contents of ore and matte.

DAILY PRICES OF METALS

NEW YORK

June	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb
5	4.8665	60⅛	15 @15½	14.80 @15.00	45⅝	4.30 @4.35	4.17½ @4.20	5.10 @5.20	4.95 @5.05
6	4.8685	59⅞	14¾ @15½	14.75 @14.85	46⅛	4.30 @4.35	4.17½ @4.20	5.10 @5.20	4.95 @5.05
7	4.8670	59⅞	14¾ @15½	14.75 @14.85	46¼	4.30 @4.35	4.17½ @4.20	5.05 @5.15	4.90 @5.00
9	4.8675	59¾	14¾ @15	14.70 @14.80	45½	4.30 @4.35	4.17½ @4.20	5 05 @5.10	4.90 @4.95
10	4.8660	59¾	14¾ @15	14.70 @14.80	45¼	4.30 @4.35	4.17½ @4.20	5.00 @5.10	4.85 @4.95
11	4.8640	59½	14¾ @15	14.70 @14.80	45¼	4.30 @4.35	4.17½ @4.20	5.00 @5.10	4.85 @4.95

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic. We quote casting copper at 0.15c. below the price for electrolytic. The quotations for lead represent wholesale transactions in open market for good ordinary brands, both desilverized and non-desilverized; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

LONDON

June	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
5	27 11/16	66	65⅞	71⅛	209	207½	19½	22⅞
6	27 9/16	66¼	66⅛	71¾	210¼	209	19⅝	22⅞
7	27⅛	....	....	....	....	....	....	....
9	27 7/16	66⅜	66⅜	71¾	207	207½	20⅛	22⅞
10	27⅛	65⅛	65⅛	71	205½	205¾	20⅛	22¾
11	27 1/16	65⅛	65⅜	71	206¼	206½	20⅜	22⅛

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c. = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

Other Metals

Aluminum—The market has been quiet, with very little business doing. Prices are nominally unchanged. No. 1 ingots are 25½@26c. per lb. for spot, and 26@26½ for future delivery.

The latest European quotation is £90@95 per long ton in London—equal to 19.55@20.64c. per lb.—for No. 1 ingots.

Antimony—The market remains quiet with business on a moderate scale. Prices are about the same at 8.70@9c. per lb. for Cookson's; 8.20@8.50c. for Hallett's; 7.50@7.80c. for Chinese, Hungarian and other outside brands.

Quicksilver—Business is fair and prices steady at about last quotations. New York is $40 per flask of 75 lb., with 60c. for small lots. San Francisco, $39.50 for domestic, and $37 for foreign orders. London price is £7 10s. per flask, with £7 2s. 6d. named from second hands.

Gol , Silver and Platinum

Gold—The price of gold on the open market in London remained at the Bank level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was a considerable demand for gold from Berlin, but it was not sufficient to cause any premium to be offered.

Iridium—Conditions remain unchanged in this metal, with a fair demand and very limited supplies. Dealers are still asking $85 per oz. for pure metal.

Platinum—The demand continues on a fair scale and while there is no quotable change, prices are very firm at $45@46 per oz. for refined platinum and $49@52 for hard metal.

Silver—The price of silver has receded owing to the decline in the China rates, and also to the firmness of money in the London market. There is a fair inquiry but at some concession in price.

Exports of silver from London to the East, Jan. 1 to May 29, reported by Messrs. Pixley & Abell:

	1912	1913	Changes
India	£2,687,800	£3,066,000	I. £378,200
China	803,500	299,500	D. 504,000
Total	£3,491,300	£3,365,500	D. £125,800

Exports of silver from New York for the week ended June 7, were $1,020,957, to London and Paris. Imports were $78,982, from Central America and Mexico.

Zinc and Lead Ore Markets

JOPLIN, MO.—June 7

The high price of zinc blende is $46, the base per ton of 60% zinc ranging from $41 to $43.50. Calamine sold on a base of $20@22 per ton of 40% zinc. The average of all grades of zinc ore is $41.14. Lead continues unchanged at $52.50 per ton of 80% metal contents, and the average of all grades is $52.08 per ton.

SHIPMENTS WEEK ENDED JUNE 7

	Blende	Calamine	Lead ore	Value
Totals this week	11,180,740	707,190	1,881,600	$293,621
Totals 23 weeks	252,322,980	16,633,080	42,339,280	$7,110,304

Blende value, the week, $236,644; 23 weeks, $5,776,992.
Calamine value, the week, $7956; 23 weeks, $219,849.
Lead value, the week, $49,021; 23 weeks, $1,113,463.

PLATTEVILLE, WIS.—June 7

The base price paid this week for 60% zinc ore was $42@43. The base price paid for 80% lead ore was $52@53 per ton.

SHIPMENTS WEEK ENDED JUNE 7

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	3,418,650	110,000	1,162,460
Year	62,861,680	3,199,430	28,358,220

Shipped during week to separating plants, 2,506,610 lb. zinc ore.

IRON TRADE REVIEW

NEW YORK—June 11

The loss of 654,440 tons in unfilled tonnage of the United States Steel Corporation was altogether expected, seeing that there was a loss of 490,194 tons in April, and new business in May was clearly smaller than in April, while shipments were maintained. Of course the showing for the two months is a poor one. New buying has been stagnant, and, indeed, it is somewhat surprising to observe that the Corporation booked new business in May to the extent of about 40% of capacity, as a computaion indicates it did. Of the 6,324,322 tins of unfilled business left on June 1, the major part is in orders actually specified, the business being variously distributed in the different finishing branches. Thus in rails, plates and shapes the Corporation is assured of practically full operation for about four months and in bars for two or three months, while in sheets and tinplates curtailment of output is probable within 30 days, and in tubular goods within about the same time, while in wire products there has been curtailment for several weeks.

It is fully realized among the steel mills that production in the next few months is almost wholly a question of how long the business now on books will last. The new business coming in is of negligible proportions. The curtailment in wire output which has already occurred, has released steel to other departments and some departments are still short. No material curtailment in total steel output is likely this month, but in July extensive closings for repairs will occur, which may tide over if a buying movement commences in August, as the more sanguine now predict.

Finished-steel prices are in the main well maintained, partly because current shipments are largely on old contracts at somewhat less than present quoted prices, and partly also because there is so little new business that there is little incentive for prospective buyers to endeavor to break the market. Where there has been any real pressure there has been some yielding.

The United States Steel Corporation reports the total unfilled orders on its books May 31 at 6,324,322 tons, a decrease of 654,460 tons from April 30 and the lowest tonnage reported since Aug. 31, 1912.

Pig-Iron Production—The reports of the blast furnaces, as collected and published by the "Iron Age" show that on June 1, there were 285 coke and anthracite stacks in blast, having a total daily capacity of 90,200 tons; a decrease of 2500 tons from May 1. Making allowance for the charcoal furnaces, the total make of pig iron in May is estimated at 2,857,200 tons; for the five months ended May 31, at 13,895,200 tons. Of this total 9,609,200 tons, or 69.2% were made by furnaces owned or operated by steel companies.

Make of Pig Iron in Alabama, in May, is reported at 179,203 tons, 66,673 tons being for steel works' use and 112,530 tons merchant iron. For the five months ended May 30, the total make was 896,986 tons, an increase of 160,057 tons over last year.

PITTSBURGH—June 10

Prices are generally firm, though galvanized sheets declined $2 a ton a few weeks ago, and black sheets are now quotable $1 a ton lower. A formal reduction in tinplate is rumored, but there is not the slightest official warrant for the report. Wire products are easily quotable $1 a ton lower, though there is hardly a definite market at the lower figure since there is practically no buying. No official reduction has been made in wire prices from the basis of $1.80 for nails, but an official reduction of, say $3 a ton, may be predicted from precedent within a few weeks. The two last advances, of $1 a ton each, were made simply to stimulate specifications. Mills are booking very little new contract business, while specifications on old contracts range from 40% to 80% of the shipments, with different mills.

Pig Iron—Upon inquiries which were out for five weeks, during which period furnaces successively revised their quotations, the Westinghouse Electric & Manufacturing Co. purchased about 15,000 tons of foundry pig iron for second-half delivery, two-thirds to its Cleveland plant and one-third to its Pittsburgh plant, prices paid being about $14.90 delivered Pittsburgh and $14.50@14.75 delivered Cleveland. The Pittsburgh iron was on the basis of about $14, Valley, though the major portion of the iron came from furnaces slightly nearer Pittsburgh. When the inquiry was put out, May 1, the market was quoted at $15.25, Valley, but this was largely nominal. Lately it has been quotable at $14.25, and the interesting development has occurred that the furnaces which sold to Westinghouse will not duplicate the price to others, while furnaces which failed to get any of the business are quoting lower prices to others than they quoted on this inquiry. Openly, $14.25, Valley, is quoted, but it is believed that on good orders $14 could be done, and a sale of 500 tons has been made on this basis. There is a stiffer tone to the market since the Westinghouse purchases, and it is held that the cost line has been reached with enough furnaces to prevent much further decline. The market is openly quotable as follows, though the prices might possibly be shaded slightly: Bessemer, $16.50; basic, $14.50; malleable, $14.25@14.50; No. 2 foundry, $14.25; forge, $13.75@14, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The market continues very quiet as to new transactions. We quote prompt at $60 and contract at $61, Baltimore.

Steel—Buyers are holding off, expecting lower prices, while steel is really scarce for any early delivery and the mills are rather firm. One mill is offering to make scale contracts, based on pig iron, with such a basis as to give steel at considerably below the present quoted market, but as the spread between pig iron and steel is unusually large at present, and the mill will only sell on the scale basis with a long-term contract, the concession is not great. We quote billets at $26.50 and sheet bars at $27, makers' mill, Pittsburgh or Youngstown, but several sellers quote 50c. above these figures.

IRON ORE

Notwithstanding delays from ice and bad weather iron-ore shipments from the Lake Superior district in May reached a total of 7,284,212 tons, being 1,365,138 tons more than in May, 1912. For the season to June 1, shipments were as follows:

Port	1912	1913	Change
Escanaba	792,889	955,187	I. 162,298
Marquette	356,914	527,041	I. 170,127
Ashland	521,772	734,941	I. 213,169
Superior	1,995,723	2,300,271	I. 304,548
Duluth	1,294,264	2,100,220	I. 805,956
Two Harbors	1,161,554	1,532,939	I. 371,385
Totals	6,123,116	8,150,599	I. 2,027,483

So far there has been no congestion nor delay reported at Lake Erie docks.

An inquiry has been received in Cleveland for 60,000 tons of ore for export in 1914. The exporting firm stipulates that the ore shall contain 60% iron, 0.03 phosphorus, 4% silicon, and be free from copper, arsenic and all injurious substances. This inquiry is similar to inquiries recently received in New York. It is not expected to result in any business from the Lake.

COKE

Connellsville Coke—A definite departure has occurred from the $2.50 asking price on second-half furnace coke contracts, this price having been the objective point of a group of operators for two months or more. A few days ago some operators quoted $2.35, and since then there have been made quotations of $2.25 both by operators who were definitely committed to $2.50, and by operators who were simply holding aloof and mentioning no price. Furnaces have not taken hold, and expect to close at still lower figures, or buy from month to month. Prompt furnace coke continues to be quotable at $2.15, with a very light movement. Consumption has been reduced slightly, and a further decrease is to be expected, so that a price above $2 as regards any considerable quantity of coke seems improbable.

Anthracite Shipments in May were 5,995,743 tons, against 1,429,357 in May, 1912, when collieries were shut down the greater part of the month. For the five months ended May 31 the shipments were 19,905,383 long tons in 1912, and 28,881,807 in 1913; an increase of 8,976,424 tons this year.

Foreign Trade of Germany in Fuel, four months ended Apr. 30, in metric tons:

	Exports	Imports	Excess
Coal	11,399,064	3,118,559	Exp. 8,280,505
Brown coal	22,980	2,382,593	Imp. 2,359,613
Coke	2,272,414	182,114	Exp. 2,090,300
Briquettes	1,135,035	51,569	Exp. 1,083,466
Total	14,829,493	5,734,835	Exp. 9,094,658

Brown coal or lignite is imported chiefly from Austria; other coal principally from Great Britain. The exports are largely to France and Belgium.

CHEMICALS

NEW YORK—June 11

General business seems to be improving and is more actively inclined.

Arsenic—Trade is slow, and stocks are accumulating. American and Canadian producers are holding back, but Mexican shipments are arriving freely. Prices are easier, $3.25@3.50 per 100 lb. being quoted.

Copper Sulphate—A fair business is doing at unchanged prices, $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Nitrate of Soda—The dull season is on and the market is quiet. Quotations are unchanged at 2.60c. per lb. for spot, 2.55c. for June, 2.50c. for July and August, and 2.47½c. for later deliveries.

OTHER ORE MARKETS

Manganese Ores—The schedule of prices adopted by the Carnegie Steel Co. is as follows, for deliveries in the Pittsburgh district or at South Chicago: Ore containing 49% or over metallic manganese, 25c. per unit; 46 to 49%, 24c.; 43 to 46%, 23c.; 40 to 43%, 22c. These prices are based on ores containing not more than 8% silica or 0.20% phosphorus. Deductions will be made of 15c. per ton for each 1% of silica in excess of 8%; of 2c. per unit of manganese for each 0.02% of phosphorus in excess of 0.20%. Ores containing less than 40% manganese, more than 12% silica or 0.225% phosphorus are subject to acceptance or refusal at buyer's option. These prices are for domestic ores; the greater part of the ores used are imported, and are bought abroad at current market prices.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield ther is reckoned at 97%. In computing the total American supply duplications are excluded.

	Jan.	Feb.	March	April	May
Alaska shipments	1,668,328	660,250	472,293	1,730,252	1,771,508
Anaconda	21,000,000	21,250,000	22,900,000	23,800,000	25,600,000
Arizona, Ltd.	3,100,000	3,000,000	3,200,000	3,100,000	3,200,000
Copper Queen	7,554,966	6,810,706	7,558,709	8,210,166	8,301,605
Calumet & Ariz.	4,750,000	4,050,000	4,250,000	4,500,000	.....
Chino	3,298,030	3,898,998	4,464,723	3,925,409	3,883,611
Detroit	1,769,071	1,689,277	1,640,671	1,856,517	2,001,633
East Butte	1,469,000	1,325,000	1,400,000	1,400,000	.....
Mammoth	1,957,804	1,661,150	1,641,091	1,450,000	1,700,000
Giroux	650,000	*600,000	*625,000	*600,000	.....
Mason Valley	1,655,319	1,348,070	1,608,492	1,264,304	.....
Miami	.....	.....	.....	.....	1,943,900
Nevada Con.	4,169,705	4,798,537	5,555,320	5,650,608	.....
Ohio	492,760	380,849	596,651	690,001	.....
Old Dominion	2,727,000	2,381,000	2,853,000	3,040,000	2,749,000
Ray	3,610,000	3,610,000	4,287,400	4,379,128	4,384,400
Shannon	1,232,000	1,152,000	1,260,000	1,238,000	1,080,000
Tennessee	1,824,637	1,600,151	1,796,394	1,718,188	.....
United Verde*	2,900,000	2,750,000	3,000,000	3,000,000	.....
Utah Copper Co.	7,333,495	7,585,303	8,248,880	9,539,847	.....
Lake Superior*	17,500,000	19,000,000	19,000,000	17,000,000	18,750,000
Non-rep. mines*	5,675,363	5,399,849	6,203,606	.....	.....
Total prod.	96,337,478	94,950,141	102,562,230	.....	.....
Imports, bars, etc.	34,026,236	21,372,292	24,215,480	.....	.....
Total blister	130,363,714	116,318,433	126,777,710	.....	.....
Imp. ore & matte	7,563,758	9,459,432	11,911,041	.....	.....
Total Amer.	137,927,472	125,781,865	138,688,751	.....	.....
Miami†	2,932,369	2,817,200	3,102,200	2,312,900	.....
Shattuck-Arizona	1,381,422	1,136,480	1,234,450	1,158,326	.....
Brit. Col. Cos.:					
British Col. Cop.	720,260	688,312	844,735	794,000	.....
Granby	1,792,245	1,740,000	1,967,962	1,857,452	1,828,000
Mexican Cos.:					
Boleo†	2,658,880	2,535,680	2,204,720	2,811,200	.....
Cananea	5,450,000	4,880,000	4,772,000	3,581,690	.....
Moctezuma	2,913,294	2,730,914	3,062,159	2,753,240	2,695,881
Other Foreign:					
Braden, Chile	1,484,000	1,178,000	1,472,000	1,512,000	1,150,000
Cape Cop., S. Af.	770,540	712,320	732,480	586,880	.....
Kyshtim, Russia	1,644,160	1,352,960	.....	.....	.....
Spassky, Russia	974,400	1,003,520	974,400	974,400	.....
Exports from					
Chile	6,752,000	5,824,000	7,840,000	7,616,000	.....
Australia	9,744,000	5,512,000	6,944,000	6,608,000	.....
Arrivals—Europ‡	17,689,280	8,509,760	15,585,920	10,545,920	.....

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister. From May 1, Miami copper is refined in the U. S. and appears under American mines.

‡ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

	United States			Visible Stocks.		
Month	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
V, '12	126,737,836	72,702,277	69,485,945	65,066,029	134,176,000	199,242,029
VI	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII	145,328,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX	140,089,819	63,460,810	60,264,796	46,701,374	113,568,000	160,269,374
X	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V	141,319,416	81,108,321	68,285,978	75,549,108	85,948,800	161,497,908
VI	.....	.....	.....	67,474,225	77,235,200	144,709,425

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Assessments

Company	Delinq	Sale	Amt.
Algomah, Mich.	June 16	.....	$1.00
Blue Star, Ida.	May 10	June 17	0.04
Central Eureka, Calif.	June 6	July 5	0.02½
Imperial, Ida.	June 2	.....	0.002½
Lone Star, Nev.	May 29	July 3	0.01
Lucky Calumet, Ida.	May 30	June 21	0.005
Majestic, Ida.	June 2	June 25	0.003
Melcher, Utah.	May 29	June 19	0.02
Middle Swansea, Utah.	June 12	July 3	0.001
Morning Star, Ida.	May 24	June 16	0.001
Nabob, Ida.	May 19	June 16	0.005
New Arcadian, Mich.	.....	July 1	0.50
New Yerington, Nev.	June 10	June 28	0.01
Old Evergreen, Utah.	June 17	July 17	0.01
Overman, Nev.	May 28	June 18	0.05
Raven, Mont.	.....	June 25	0.15
Relonia, Utah.	May 24	June 24	0.0005
Royal, Ida.	May 31	June 23	0.001
Sandstorm Kendall, Nev.	May 12	June 16	0.01
Shasta Copper Exp., Calif.	May 28	June 16	0.025
Sierra Nevada, Nev.	June 24	July 15	0.10
Silver Flat, Utah.	June 23	July 7	0.001
Silver Pick, Nev.	June 23	July 28	0.01
Tintic Standard, Utah.	June 21	July 19	0.005
Trade Dollar Ext., Utah.	May 29	June 17	0.005
United Tintic, Utah.	June 28	July 18	0.01
Utah Mine, Utah.	June 7	June 26	0.05

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28.983
February	52.222	59.043	61.642	24.081	27.190	28.357
March	52.745	58.375	57.870	24.324	26.875	26.669
April	53.325	59.207	59.490	24.595	27.284	27.416
May	53.308	60.880	60.361	24.583	28.038	27.825
June	53.043	61.290	.....	24.486	28.215	.....
July	52.630	60.654	.....	24.286	27.919	.....
August	52.171	61.606	.....	24.082	28.375	.....
September	52.440	63.078	.....	24.209	29.088	.....
October	53.340	63.471	.....	24.594	29.299	.....
November	55.719	62.792	.....	25.649	29.012	.....
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York				London, Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	14.971	14.329	15.253	62.893	65.519
March	14.698	14.713	14.868	14.930	65.884	65.329
April	15.741	15.291	15.930	15.565	70.294	68.111
May	16.631	15.436	16.245	15.738	72.352	68.807
June	17.234	.....	17.443	.....	78.259	.....
July	17.190	.....	17.353	.....	76.636	.....
August	17.498	.....	17.644	.....	78 670	.....
September	17.508	.....	17.598	.....	78.762	.....
October	17.314	.....	17.631	.....	76.389	.....
November	17.326	.....	17.617	.....	76.890	.....
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	42.962	48.766	195.036	220.150
March	42.577	46.832	192.619	213.645
April	43.923	49.115	200.513	224.119
May	46.063	49.038	208.830	224.143
June	45.815	.....	205.863	.....
July	44.519	.....	202.446	.....
August	45.857	.....	208.351	.....
September	49.135	.....	223.762	.....
October	50.077	.....	228.353	.....
November	49.891	.....	227.619	.....
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	4.325	3 946	4.175	15.738	16.550
March	4.073	4.327	4.046	4.177	15.997	15.977
April	4.200	4.381	4.118	4.242	16 331	17.597
May	4.194	4.342	4 072	4.226	16 509	18.923
June	4.392	.....	4.321	.....	17 588	.....
July	4.720	.....	4.603	.....	18 544	.....
August	4.569	.....	4 452	.....	19.655	.....
September	5.048	.....	4.924	.....	22.292	.....
October	5.071	.....	4.894	.....	20 630	.....
November	4.615	.....	4.463	.....	18 193	.....
December	4 303	.....	4.152	.....	18 069	.....
Year	4.471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6.089	26.661	25.338
March	6.626	6.078	6.476	5.926	26.048	24.605
April	6.633	5.641	6 483	5.491	25 644	25.313
May	6.679	5.406	6.529	5.256	25.790	24.583
June	6.877	.....	6 727	.....	25.763	.....
July	7.116	.....	6 966	.....	26 174	.....
August	7.028	.....	6.878	.....	26.443	.....
September	7.454	.....	7 313	.....	27.048	.....
October	7.426	.....	7.276	.....	27.543	.....
November	7 371	.....	7.221	.....	26.804	.....
December	7.162	.....	7.081	.....	26.494	.....
Year	6.943	.....	6.799	.....	26.421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURG

Month	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	18.15	13.66	16.96	14 10	17.53
April	15.13	17.90	13.90	16.71	14.15	16.40
May	15.14	17.68	13.90	15.80	14.12	15.40
June	15.15	.....	14.11	.....	14 22	.....
July	15.15	.....	14.38	.....	14.38	.....
August	15.43	.....	14 90	.....	14.85	.....
September	16.86	.....	16.03	.....	15.63	.....
October	17.90	.....	17.18	.....	17.22	.....
November	18.07	.....	17 09	.....	18.00	.....
December	18.15	.....	17.45	.....	18 73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS June 10

Name of Comp.	Bid.
Acacia	.02¾
Cripple Cr'k Con.	.01
C. K. & N.	.12½
Doctor Jack Pot.	.06¾
Elkton Con.	.51½
El Paso	3.35
Findlay	.03
Gold Dollar	.10
Gold Sovereign	.02¾
Isabella	.10½
Jack Pot	.05
Jennie Sample	.05¾
Lexington	‡.008
Moon Anchor	‡.01
Old Gold	.02
Mary McKinney	.54½
Pharmacist	.01½
Portland	.96
Vindicator	.90
Work	‡.004

SALT LAKE June 10

Name of Comp.	Bid.
Beck Tunnel	.05½
Black Jack	.08½
Cedar Talisman	.01
Colorado Mining	.11½
Columbus Con.	‡.06
Crown Point	.02
Daly-Judge	6.35
Grand Central	.55
Iron Blossom	1.30
Little Bell	‡.35
Lower Mammoth	.03½
Mason Valley	‡5.00
May Day	.05½
Nevada Hills	.85
New York	.01
Prince Con	30
Silver King Coal'n	3.40
Sioux Con.	.02½
Uncle Sam	.04
Yankee	.08

TORONTO June 9

Name of Comp.	Bid	Name of Comp.	Bid
Bailey	.07	Foley O'Brien	.26
Coniagas	7.00	Hollinger	15.00
T. & Hudson Bay	‡65.00	Imperial	‡.03
Timiskaming	.33	Jupiter	.35
Wettlaufer-Lor.	.11	Pearl Lake	.43
Apex	‡.01	Porcu. Gold.	.10
Crown Chartered	‡.00½	Preston E. D.	.04
Dobie	.25	Rea	.12
Dome	‡15.00	Swastika	.04
Dome Exten.	.08	West Dome	.12

SAN FRANCISCO June 10

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS.		MISC. NEV. & CAL.	
Alta	‡.01	Belmont	6.05
Belcher	.18	Jim Butler	.67
Best & Belcher	.05	MacNamara	.15
Caledonia	.75	Midway	.38
Challenge Con.	.02	Mont.-Tonopah	1.20
Chollar	.01	North Star	.71
Confidence	.23	West End Con.	1.02½
Con. Virginia	.05	Atlanta	.14
Crown Point	.16	Booth	.03
Gould & Curry	02	C.O.D. Con.	.04
Hale & Norcross	.05	Comb. Frac.	.03
Mexican	.62	Jumbo Extension	.22
Occidental	70	Pitts.-Silver Peak	.27
Ophir	.09	Silver Pick	.03
Overman	‡.24	St. Ives	‡.30
Potosi	.01	Tramp Con.	.01
Savage	.06	Argonaut	‡1.60
Sierra Nevada	.04	Bunker Hill	1.90
Union Con.	.06	Central Eureka	.12
Yellow Jacket	.20	So. Eureka	2.75

N. Y. EXCH. June 10

Name of Comp.	Clg.
Amalgamated	62⅞
Am. Agri. Chem.	47
Am.Sm.&Ref.,com	59½
Am. Sm. & Ref., pf.	97⅝
Am. Sm. Sec., pf. B	80¼
Anaconda	32½
Batopilas Min.	1
BethlehemSteelpf	62⅛
Chino	32½
Federal M. & S., pf.	33⅝
Goldfield Con.	1⅜
GreatNor.,ore,ctf.	26
Guggen. Exp.	41¼
Homestake	101
Inspiration Con.	14⅞
Miami Copper	20⅞
Nat'nalLead,com.	43¼
National Lead, pf.	102¼
Nev. Consol.	13⅞
Phelps Dodge	200
Pittsburg Coal, pf.	73¾
Ray Con.	15⅝
Republic I&S,com.	17¾
Republic I & S, pf.	72⅛
SlossSheffil'd,com.	25
Sloss Sheffield, pf.	82
Tennessee Copper	27½
Utah Copper	40½
U. S. Steel, com.	51⅛
U. S. Steel, pf.	103½
Va.Car. Chem., pf.	97⅛

N. Y. CURB June 10

Name of Comp.	Clg.
Barnes King	1¼
Beaver Con.	.35
Braden Copper	6⅛
B. C. Copper	2
Buffalo Mines	2¼
Caledonia	‡.40
Con. Ariz. Sm.	⅝
Davis-Daly	1⅞
Diam'field-Daisy	.04
Ely Con.	.07
Florence	.40
Giroux	1⅝
Gold Hill Con.	‡¼
Greene Cananea	5⅞
Greenwater	05
Internat. S. & R.	109
Kerr Lake	3
Keystone	‡2
La Rose	2⅛
McKinley-Dar-Sa.	1⅜
Min. Co. of A. new	2½
Motherlode Gold.	‡.60
Nipissing Mines	8⅛
Ohio Copper	⅝
Pacific Sm. & M.	¼
Puebla S. & R.	2
South Live Oak	‡2
South Utah M. & S.	⅛
Standard Oil (Old)	‡1030
Stand'd Oil of N.J.	345
Stewart	1½
Tonopah	4⅞
Tonopah Ex.	2 1/16
Tonopah Merger	.64
Tri-Bullion	¼
Tularosa	⅛
Union Mines	⅛
United Cop., pfd.	3
Yukon Gold	2 1/16

LONDON June 4

Name of Com.	Clg.
Camp Bird	£0 18s 3d
El Oro	0 14 3
Esperanza	1 1 3
Mexico Mines	5 12 6
Oriental Con.	‡1 8 4
Oroville	0 6 3
Santa Gert'dis	1 5 0
Tomboy	1 7 6

BOSTON EXCH. June 10

Name of Comp.	Clg.
Adventure	1
Ahmeek	285
Algomah	.20
Allouez	29⅛
Am. Zinc	19¾
Ariz. Com., ctfs.	2⅛
Bonanza	.35
Boston & Corbin	⅛
Butte & Balak	1¾
Calumet & Ariz.	57½
Calumet & Hecla	406
Centennial	10
Cliff	1⅛
Copper Range	38
Daly West	2
East Butte	9⅛
Franklin	4¼
Granby	52⅛
Hancock	15
Hedley Gold	30½
Helvetia	⅛
Indiana	7
Island Cr'k, com.	45¼
Island Cr'k, pfd.	80½
Isle Royale	16½
Keweenaw	1½
Lake	8½
La Salle	3⅜
Mass	2½
Michigan	½
Mohawk	41
New Arcadian	½
New Idria Quick	3⅞
North Butte	22⅜
North Lake	1
Ojibway	½
Old Dominion	42½
Osceola	78
Quincy	56
Shannon	7½
Shattuck-Ariz.	21
Superior	23
Superior & Bost.	1⅞
Tamarack	21
Trinity	3
Tuolumne	2
U. S. Smelting	35½
U. S. Smelt'g, pf.	46
Utah Apex	1⅜
Utah Con.	7½
Victoria	.90
Winona	1
Wolverine	41
Wyandot	¾

BOSTON CURB June 10

Name of Comp.	Last
Alaska Gold M.	9
Bingham Mines	3
Boston Ely	.45
Boswyocolo	‡.01
Butte Central	.99
Cactus	05
Calaveras	3
Chief Cons	1½
Corbin	60
Cortez	.30
Crown Reserve	3
Eagle & Blue Bell	.92
First Nat. Cop.	1½
Majestic	.35
Mexican Metals	.48
Moneta Porc.	‡.06
Nevada-Douglas	1⅞
New Baltic	.90
Oneco	⅞
Raven Copper	.04
Rhode Island Coal	03
Smokey Dev.	1½
S. W. Miami	2
South Lake	3
Trethewey	.33
United Verde Ext.	.60

‡Last quotation.